

# ARITHMETICK,

Both in the

## THEORY and PRACTICE,

Made plain and easy in all the Common and Useful RULES, both in

Whole Numbers and Fractions,

VULGAR and DECIMAL.

Also INTEREST { *Simple and* } and ANNUITIES.  
                          { *Compound,* }

LIKEWISE

Extraction of the Square and Cube Roots.

AS ALSO

The Tables and Construction of LOGARITHMS,  
with their Use in ARITHMETICK, and  
COMPOUND INTEREST.

Together with Arithmetical and Geometrical Progression,  
and the Combination and Election, Permutation, and  
Composition of NUMBERS and QUANTITIES.

With the Addition of several ALGEBRAICAL QUESTIONS.

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The like not Extant.

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By JOHN HILL, Gent.

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With a PREFACE by H. DITTON, Gent.

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The TENTH EDITION, accurately Revised, Corrected,  
and Improved by Mr. E. HATTON, and others.

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L O N D O N;

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LONDON.

Printed for C. Hutton, at the New York, J. Richardson,  
D. Baskin, at the New York, J. Richardson, and Co.,  
J. Baskin, at the New York, J. Richardson, and Co.,  
and R. Hutton.





# TO THE READER.

**I** being a sort of Disparagement to Things which are evidently very good, to say much in Commendation of them; I shall therefore, in Justice to this Book, give but a very short Account of it.

It appears to me, upon the Perusal of it, to be a curious Piece: 'Tis clean, methodical, and handsomely dressed: So plain, that the dullest Person may learn by it; and so compleat, that he need learn no more.

The Author (whoever he was) has, in this Treatise, gone much beyond the Bounds which the common Writers of this Science use to advance to.

## To the READER.

*And tho' many of the Practices he delivers, Ex. gr. the making of LOGARITHMS, INTEREST, and COMBINATION of QUANTITIES, are to be done with greater Advantage and Exactness, by the Help of Superior Methods, as ALGEBRA, &c. yet take him purely as an Arithmetician, and he has not only done more, and much better, than Wingate, Cocker, Leybourn, or any other of the Writers in our Tongue, but indeed all, that can be done by Arithmetick. And therefore, if no other Book on this Subject comes out 'till this Performance is really mended, I am satisfied we shall have no new Book of Arithmetick very soon.*

CHRIST's Hospital,  
Nov. 12, 1712.

H. DITTON.

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**I** Have perused this Book; and finding it very well done, recommend it to such as desire a good Knowledge in Arithmetick.

*From my School  
in Foster-Lane,  
March 7, 17<sup>20</sup>/<sub>11</sub>.*

C. SNELL.



# ARITHMETICK,

Both in the

## THEORY and PRACTICE.

### The INTRODUCTION.

#### SECTION I.

*Containing the General Præcognita.*

1. **A**RITHMETICK is an Art or Science, that teacheth us the dextrous handling of Numbers, and contains three Branches,

viz. { VULGAR,  
LOGARITHMICAL,  
ANALYTICAL.

2. For the well managing of which, the *Arabians*, as may be supposed by their Way of Reading, invented the following Symbols, or Characters, commonly called Digits (as may be reasonably guess'd from the Fingers of the Hand) which, though few in Number, are sufficient for managing the vastest Calculations.

*See here their Names and Characters.*

|     |     |       |      |      |     |       |       |      |       |
|-----|-----|-------|------|------|-----|-------|-------|------|-------|
| 1   | 2   | 3     | 4    | 5    | 6   | 7     | 8     | 9    | 0     |
| One | Two | Three | Four | Five | Six | Seven | Eight | Nine | Null. |

## 2. The INTRODUCTION.

3. The Cypher, Null, standing by itself, signifieth Nothing; but being joined with other Numbers, increaseth, or decreaseth their Value, and is indeed the Beginning of all Number, as we shall elsewhere demonstrate, contrary to what Tacquet, and some other modern Artists affirm.

4. Number is composed of one or a Multitude of Units, and is that by which we say any thing is numbered; as 1 Acre, 4 Crowns, 7 Days in a Week.

5. Of Numbers are several Sorts; as Digits, Articles, Compounds, whole, Broken, Mixed, &c.

6. Digits are such Numbers as are under Ten, as 2, 3, 4, 5, &c.

7. Articles are such Numbers as are composed of a Digit and a Cypher, as 10, 20, 30, &c. and are divisible by 10 without a Remainder.

8. Compound Numbers are such as are compounded, of many Numbers, as 144, 282, 1702, 1728, &c.

9. A whole Number either contains Unity, or some Number thereof; as 7, 21, 512, 2056, &c.

10. A Fraction, or broken Number, is always less than Unity, as  $\frac{3}{4}$  represent three Quarters of any Thing, or Unity; and  $\frac{6}{10}$ , or 6 is six tenth Parts of Unity, &c.

11. A mixt Number is always greater than Unity, as  $2\frac{1}{2}$  represents 2 Integers, and one half of an Integer or Unity, and  $7\frac{75}{100}$ , or 7.75, signifies 7 Integers, and 75 hundred Parts of an Integer or Unity.

12. According to the Division of Unity, a Fraction comes to be stiled Vulgar or Decimal.

13. A Vulgar Fraction is divided into two Parts, one above another, with a small Line drawn betwixt, of which the lower is called the Denominator, and the higher the Numerator, shewing how many of those Parts are signified by the Fraction. So if we divide Unity into 12 Parts, 5 of those Parts will be expressed thus  $\frac{5}{12}$  Numerator, and 7 Parts thus  $\frac{7}{12}$ , and so others.

14. A Decimal Fraction (which is the most genuine and natural way of dividing Unity, and perhaps the most ancient) always supposes the Integer to be divided into 10, 100, 1000 Parts, &c. as you covet Preciseness in your Operation. Hence the Denominator being known, needs not to be expressed, but you may place your Fraction as an Integer, by taking care to prefix its distinguishing Point,

or



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or Comma; so  $\frac{1}{10}$  will be expressed thus,  $\frac{1}{10}$ , and  $\frac{1}{100}$  thus,  $\frac{1}{100}$ ;  $\frac{1}{1000}$  thus,  $\frac{1}{1000}$ , &c.

15. Numbers are said again to be Equal, Unequal, Even, Odd, Evenly even, Evenly odd, Oddly odd, Composite, Prime, Plain, Solid, Perfect, Harmonic, Square, Cube, &c.

16. Equal Numbers are such as contain an equal Number of Units.

17. Unequal Numbers are such whose Number of Units differ.

18. An even Number is such as may be divided into two equal Parts.

19. An odd Number is such as cannot be divided into two equal Parts.

20. A Number evenly even, is such as is composed of two even Numbers, such an one is 8, for  $2 \times 4 = 8$ .

21. A Number evenly odd, is such as is composed of an even and an odd Number; such is 18, composed of 6 and 3, for  $6 \times 3 = 18$ ; of 9 and 2, for  $9 \times 2 = 18$ .

22. A Number oddly odd, is such as is composed of two odd Numbers; such is 21, composed of 7 and 3, for  $7 \times 3 = 21$ .

23. Some Numbers are both evenly even, and evenly odd, as 24 composed of 6 and 4, for  $6 \times 4 = 24$ , and so is evenly even; and it may be composed of 8 and 3, for  $8 \times 3 = 24$ , and so is evenly odd.

24. Composite Numbers are such as are measured by some other Number than Unity, such are 8, 12, 15, 25, &c.

25. Prime or Incomposite Numbers, are such as Unity only measureth; such are 3, 5, 7, 11, 17, 19, &c.

26. Plain Numbers are such as are made by the Multiplication of two Numbers, as 12, 18, 36; the first made up of 6 and 2, and the second of 6 and 3, and the third of 9 and 4.

27. Solid Numbers are such as are made by the Multiplication of three Numbers into one another; such are 24 made by the Multiplication of 2 into 3, into 4; and 60 made of 3 into 4, into 5; whence you may infer, that all Plain and Solid Numbers are Composite.

28. Perfect Numbers are such, whose Aliquot Parts added, are equal to themselves; the first of which is 6, whose Aliquot Parts are 3, 2, 1 = 6: The second is 28, whose Aliquot Parts are 14, 7, 4, 2, 1 = 28; of these Numbers are but few, only nine in a Hundred Thousand Millions.



29. Harmonic Numbers are such, that the Aliquot Parts of the one collected, make a Sum equal to the other Number.

30. Square Numbers are such as are made by the Multiplication of some Number into itself; so 4 is the Square of 2, 9 of 3, 16 of 4, and so on *ad infinitum*.

31. Cube Numbers are made by the Multiplication of some Number twice into itself, such a one is 8, made by the Multiplication of 2 into 2 into 2. such another is 27, and infinite more.

32. Numbers to one another may be termed Aliquot Parts, Aliquant Parts, Prime, Composite.

33. One Number is said to be an Aliquot Part to another, when the first precisely measures the second; so 6 is an Aliquot Part of 18, and 7 of 28; for 6 measures 18 by 3, and 7 measures 28 by 4, &c.

34. One Number is said to be an Aliquant Part of another Number, when the first measures not the second without a Remainder; so 5 is an Aliquant Part of 18, and 9 of 25, &c.

35. One Number is said to be Prime to another, when no Number can be found to measure both precisely, excepting Unity; so 11 and 15 are Prime to one another; so are 13 and 36, and many more.

36. One Number is Composite to another, when a Number can be found that measures both exactly besides Unity, such are 12 and 36, 15 and 75; since 3 measures the first Pair, and 5 the second, and so in many more.

37. Numbers to one another may be said to have Reason, Ratio, or Habitude, and may be twofold, either in respect of Quantity or Quality.

38. In respect of Quantity, it is considered only betwixt two Numbers, of which the first is called the Antecedent, the second the Consequent, and is either equal, as 3 to 3, or 7 to 7; or unequal, which may be of the Greater to the Less, as 6 to 4, or of the Less to the Greater, as 4 to 6.

39. Reason, as well of the Greater to the Less, as of the Less to the Greater, is five fold, *viz.* First, *Multiple*; Secondly, *Superparticular*; Thirdly, *Superpartiens*; Fourthly, *Multiple superparticular*; Fifthly, and lastly *Multiple superpartiens*. The three first of which are called Simple,

## The INTRODUCTION.

Simple, the two last Mixt, Reason or Habitude; to give a Name to their Opposites or Contraries, we join the Preposition *Sub*; then they are called *Submultiple*, *Subsuperparticular*, &c.

40. First, *Multiple Reason*, is when the Antecedent, or Greater Number contains the Consequent, or less Number some certain Number of times, without a Remainder, as 6 to 3, commonly called *Duple*; 21 to 7, commonly called *Triple*. Reason, their Opposites are of the Less to the Greater, as 3 to 6, 7 to 21, that is, *Subduple*, *Subtriple Reason*.

41. Secondly, *Superparticular Reason*, is when the Antecedent, or Greater Number, contains the Consequent, or Less Number, but once with a Fraction, whose Numerator is always Unity; such are 3 to 2, 4 to 3, 5 to 4, &c. commonly call'd *Sesquialtera*, *Sesquitercia*, *Sesquiquarta*, Reason or Proportion: Its Opposite is *Subsuperparticular*, as of 2 to 3, 3 to 4, 4 to 5, &c. commonly called *Subsesquialtera*, *Subsesquitercia*, *Subsesquiquarta*, &c.

42. Thirdly, *Superpartient Reason*, is when the Antecedent or Greater Number contains the Consequent or Less Number once with a Fraction, whose Numerator is always more than Unity; such as 5 to 3, 17 to 4, &c. commonly called *Superdupartiens tres*, and *Supertripartiens quartas*, &c. Its Opposite is *Subsuperpartient*, as of 3 to 5, 4 to 17, or *Subsuperdupartiens tres*, *Subsupertripartiens quartas*, &c.

43. Fourthly, *Multiple superparticular Reason*, is when the Antecedent or Greater Number contains the Consequent or Less Number divers times with a Fraction, whose Numerator is always Unity; such as 9 to 4, or *Duplasesquiquarta*, 9 to 2, or *Quadruplasesquialtera*, 26 to 5, or *Quintaplasesquiquinta*, &c. Its Opposite is *Submultiple superparticular*, as 4 to 9, 2 to 26, &c.

44. Fifthly, *Multiple superpartient Reason*, is when the Antecedent or Greater Number contains the Consequent or Less Number divers times with a Fraction, whose Numerator is always greater than Unity; as 8 to 3, commonly called *Duplasuperdupartiens tertia*, 19 to 5, termed *Triplasuperquadripartiens quinta*, &c. Its Opposite is *Submultiple superpartient*, as 3 to 8, 5 to 19, &c. Under some of these five Species are comprehended all the Vari-

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riety that can happen betwixt two Numbers, in respect of Quantity; the same holds also in Fractions, as well as mixt Numbers.

45. In respect of Quality, which is only a Similitude of Reasons, commonly called Proportion, it is considered betwixt more than two Numbers. For tho' the Reason of two Numbers may be had, as before, yet a Similitude of Reasons cannot be found, unless the Numbers be more than two, and is threefold: First, in respect of their *Difference*. Secondly, In respect of their *Quote*. Thirdly, In respect of both. Of the first, springeth Arithmetical; of the second, Geometrical; of the third, Harmonical Proportion.

46. Arithmetical Proportion, is an Equality of Differences; that is to say, when a Rank of Numbers have one and the same Difference; and this is two-fold, continued, or discontinued.

47. First, Continued; when of several, the 2d exceeds or is less than the first by the same Number of Units, as the 3d exceeds or is less than the 2d, or as the 4th exceeds or is less than the 3d, &c. So 1, 3, 5, 7, 9, 11, &c. are Numbers in Arithmetical Proportion, increasing by 2. And 16, 13, 10, are Numbers in Arithmetical Proportion, decreasing by 3. And 1, 2, 3, 4, 5, 6, 7, are Numbers in Arithmetical Proportion, continued, increasing by Unity; and these are what is commonly called *Arithmetical Progression*.

48. Secondly, Discontinued, that is, when there is the same Difference betwixt the 1st and the 2d, as there is betwixt the 3d and 4th, but not as between the 2d and 3d. So 1, 3, 7, 9, are four Numbers in Arithmetical Proportion. The Difference of 1 and 3, and of 7 and 9, being 2; which is not the Difference of 3 and 7, which is 4.

49. Geometrical Proportion is an Equality of *Ratios*; that is to say, when several Numbers, being divided by one another, have several Quotients, and is either Continued or Discontinued.

50. Continued, when of several Numbers the 1st bears the same *Ratio*, or Proportion to the 2d, as the 2d doth to the 3d, and as the 3d doth to the 4th, &c. Thus 2, 3, 4, 6, are Geometrical Proportionals continued, since there is the same Reason of 2 to 3, as of 4 to 6,  
each



## The INTRODUCTION.

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each being *Subsesquialtera*, 1, 2, 4, 8, 16, 32, &c. are Numbers in Geometrical Proportion, for the same Reason; and this is what is commonly called *Geometrical Progression*.

51. Second, Discontinued or Interrupted, when the Proportion of the 1st to the 2d is the same as that of the 3d to the 4th, but not of the 2d to the 3d. Thus,  $3:6::16:32$ , are Geometrical Proportions discontinued; 3 being contained in 6 as often as 16 in 32, that is twice, which is not the Proportion of 6 to 16; and this is what is commonly called *The Golden Rule*.

52. Harmonic, or Musical Proportion, is when the 1st Term is to the last as the Difference of the 1st and 2d to the Difference of the two last. So these three Numbers, 2, 3, 6, are in Musical Proportion, since 2 is to 6, As 1, the Difference of the two first, To 3, the Difference of the two last. Thus also these 4 Numbers are in Harmonical Proportion, viz. 2, 3, 6, 12; since the first is to the last, As the Difference of the two first, To the Difference of the two last.

## S E C T. II.

### *The Division of a Pound Sterling.*

|              |   |      |            |
|--------------|---|------|------------|
| 4 Farthings  | } | Make | 1 Penny    |
| 12 Pence, or |   |      |            |
| 3 Groats     |   |      | 1 Shilling |
| 5 Shillings  |   |      | 1 Crown    |
| 4 Crowns, or |   |      |            |
| 20 Shillings |   |      | 1 Pound    |

|                |   |      |          |
|----------------|---|------|----------|
| 20 Groats, or  | } | Make | 1 Noble  |
| 6s. and 8d.    |   |      | 1 Mark   |
| 2 Nobles       |   |      | 1 Pound  |
| 2 Angels       |   |      | 2 Pounds |
| 3 Marks        |   |      | 1 Pound  |
| 1 Mark 1 Noble |   |      | 1 Pound  |
| 240 Pence      |   |      | 1 Pound  |
| 960 Farthings  |   |      | 1 Pound  |

# *The INTRODUCTION.*

## *The Division of a Pound Troy.*

|                      |        |               |                   |
|----------------------|--------|---------------|-------------------|
| 24 Grains            | } Make | 1 Penny Wt.   | 240 Penny         |
| 20 Penny Weight      |        | 1 Ounce       | Wt. make a        |
| 12 Ounces            |        | 1 Pound Troy  | Pound. So         |
| 14 Oup. 12 Penny Wt. |        | 1 Pound Aver. | will 5760 Grains. |

## *Averdupoise Weight.*

|                       |        |                       |                            |
|-----------------------|--------|-----------------------|----------------------------|
| 16 Drams              | } Make | 1 Ounce               | 256 Drams                  |
| 16 Ounces             |        | 1 Pound               | make a lb.                 |
| 14 Pound              |        | 1 Stone               | 1792 Ounces                |
| 2 Stone, or 28 Pound  |        | $\frac{1}{2}$ Hundred | make a C.                  |
| 4 Stone, or 56 Pound  |        | $\frac{1}{2}$ Hundred | Wt. 28672                  |
| 8 Stone, or 112 Pound |        | 1 Hundred             | Dr. make a                 |
| 5 Hundred             |        | 1 Hoghead             | C. Wt. 3584                |
| 10 Hundred            |        | 1 Pipe or Butt        | Dr. make a                 |
| 20 Hundred            |        | 1 Tun or Load         | Stone, so will 224 Ounces. |

## *Apothecaries Weight.*

|            |        |           |                                 |
|------------|--------|-----------|---------------------------------|
| 20 Grains  | } Make | 1 Scruple | 96 Drams in a                   |
| 3 Scruples |        | 1 Dram    | Pound, 288 Scruples in a Pound; |
| 8 Drams    |        | 1 Ounce   | 5760 Grains in a                |
| 12 Ounces  |        | 1 Pound   | Pound.                          |

*N. B.* Apothecaries compound their Medicines by the Weights expressed in the above Table; but they buy and sell their Drugs by Averdupoise Weight.

*Long*

# The INTRODUCTION.

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## Long Measure.

|                        |   |              |               |
|------------------------|---|--------------|---------------|
| 3 Barley Corns         | 1 | Inch         | 109380 Bar.   |
| 4 Inches               | 1 | Palm         | Cor. make 1   |
| 12 Inches, or 3 Palms  | 1 | Foot         | Mile 63360    |
| 3 Feet                 | 1 | Yard         | Inches make 1 |
| 3 Feet 9 Inches        | 1 | Ell English  | 1 Mile 5380   |
| 5 Feet, or 30 Bar.     | 1 | Geomet. Pace | Feet make 1   |
| 6 Feet, or 2 Yards     | 1 | Fathom       | Mile 1960     |
| 5 $\frac{1}{2}$ Yards  | 1 | Perch        | Yards make 1  |
| 40 Perch, or 132 Paces | 1 | Furlong      | 1 Mile 1056   |
| 8 Furl. or 320 Perch.  | 1 | Mile         | Paces make 1  |
| 3 Miles                | 1 | League       | 1 Mile 320    |
|                        |   |              | Perch make 1  |
|                        |   |              | 1 Mile.       |

## Cloth Measure.

|            |   |             |                          |
|------------|---|-------------|--------------------------|
| 4 Nails    | 1 | Quarter     |                          |
| 4 Quarters | 1 | Yard        | 16 Nails one Yard        |
| 5 Quarters | 1 | Ell English | 20 Nails one Ell English |
| 3 Quarters | 1 | Ell Flemish | 12 Nails 1 Ell Flemish   |

## Dry Measure.

|            |   |                       |  |
|------------|---|-----------------------|--|
| 2 Pints    | 1 | Quart                 |  |
| 2 Quarts   | 1 | Pottle                |  |
| 4 Pottles  | 1 | Gallon                |  |
| 2 Gallons  | 1 | Peck                  |  |
| 4 Pecks    | 1 | Buschel Land Measure  |  |
| 3 Pecks    | 1 | Buschel Water Measure |  |
| 4 Bushels  | 1 | Coomb                 |  |
| 2 Coombs   | 1 | Quarter               |  |
| 4 Quarters | 1 | Chalder               |  |
| 5 Quarters | 1 | Tun, or Wey           |  |

## Liquid



# The INTRODUCTION.

## The Division of a Pound Troy.

|                      |        |                |            |
|----------------------|--------|----------------|------------|
| 24 Grains            | } Make | 1 Penny Wt.    | 240 Penny  |
| 20 Penny Weight      |        | 1 Ounce        | Wt. make a |
| 12 Ounces            |        | 1 Pound Troy   | Pound. So  |
| 14 Oun. 12 Penny Wt. |        | 1 Pound Averd. | will 5760  |
|                      |        |                | Grains.    |

## Averdupoise Weight.

|                       |        |                |                |
|-----------------------|--------|----------------|----------------|
| 16 Drams              | } Make | 1 Ounce        | 256 Drams      |
| 16 Ounces             |        | 1 Pound        | make a lb.     |
| 14 Pound              |        | 1 Stone        | 1792 Ounces    |
| 2 Stone, or 28 Pound  |        | 1 Hundred      | make a C.      |
| 4 Stone, or 56 Pound  |        | 1 Hundred      | Wt. 28672      |
| 8 Stone, or 112 Pound |        | 1 Hundred      | Dr. make a     |
| 5 Hundred             |        | 1 Hoghead      | C. Wt. 3584    |
| 10 Hundred            |        | 1 Pipe or Butt | Dr. make a     |
| 20 Hundred            |        | 1 Tun or Load  | Stone, so will |
|                       |        |                | 224 Ounces,    |

## Apothecaries Weight.

|            |        |           |                    |
|------------|--------|-----------|--------------------|
| 20 Grains  | } Make | 1 Scruple | 96 Drams in a      |
| 3 Scruples |        | 1 Dram    | Pound, 288 Scr-    |
| 8 Drams    |        | 1 Ounce   | uples in a Pound ; |
| 12 Ounces  |        | 1 Pound   | 5760 Grains in a   |
|            |        |           | Pound.             |

N. B. Apothecaries compound their Medicines by the Weights expressed in the above Table ; but they buy and sell their Drugs by Averdupoise Weight.

Long

# The INTRODUCTION.

9

## Long Measure.

|                        |        |                |              |
|------------------------|--------|----------------|--------------|
| 3 Barley Corns         | } Make | 1 Inch         | 100080 Bar.  |
| 4 Inches               |        | 1 Palm         | Cor. make 1  |
| 12 Inches, or 3 Palms  |        | 1 Foot         | Mile, 63360  |
| 3 Feet                 |        | 1 Yard         | Inches make  |
| 3 Feet 9 Inches        |        | 1 Ell English  | 1 Mile, 5280 |
| 5 Feet                 |        | 1 Geomet. Pace | Feet make 1  |
| 6 Feet, or 2 Yards     |        | 1 Fathom       | Mile, 1960   |
| 5 $\frac{1}{2}$ Yards  |        | 1 Perch        | Yards make   |
| 40 Perch, or 132 Paces |        | 1 Furlong      | 1 Mile, 1056 |
| 8 Furl. or 320 Perch.  |        | 1 Mile         | Paces make   |
| 3 Miles                |        | 1 League       | 1 Mile, 320  |
|                        |        |                | Perch make   |
|                        |        |                | 1 Mile.      |

## Cloth Measure.

|            |        |               |                          |
|------------|--------|---------------|--------------------------|
| 4 Nails    | } Make | 1 Quarter     |                          |
| 4 Quarters |        | 1 Yard        | 16 Nails one Yard        |
| 5 Quarters |        | 1 Ell English | 20 Nails one Ell English |
| 3 Quarters |        | 1 Ell Flemish | 12 Nails 1 Ell Flemish.  |

## Dry Measure.

|            |        |                        |  |
|------------|--------|------------------------|--|
| 2 Pints    | } Make | 1 Quart                |  |
| 2 Quarts   |        | 1 Pottle               |  |
| 4 Pottles  |        | 1 Gallon               |  |
| 2 Gallons  |        | 1 Peck                 |  |
| 4 Pecks    |        | 1 Bushel Land Measure  |  |
| 5 Pecks    |        | 1 Bushel Water Measure |  |
| 4 Bushels  |        | 1 Coomb                |  |
| 2 Coombs   |        | 1 Quarter              |  |
| 4 Quarters |        | 1 Chalder              |  |
| 5 Quarters |        | 1 Tun, or Wey          |  |

## Liquid

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## Liquid Measure.

|                         |        |                           |
|-------------------------|--------|---------------------------|
| 2 Pints                 | } Make | 1 Quart                   |
| 2 Quarts                |        | 1 Pottle                  |
| 2 Pottles               |        | 1 Gallon (Herrings)       |
| 3 Gallons               |        | 1 Firkin of Ale, Soap, or |
| 9 Gallons               |        | 1 Firkin of Beer          |
| 2 Firkins               |        | 1 Kilderkin               |
| 2 Kilderkins            |        | 1 Barrel, or 36 Gallons   |
| 4 Gallons               |        | 1 Tierce                  |
| 63 Gallons              |        | 1 Hogshead                |
| 2 Hogsheads             |        | 1 Pipe or Butt            |
| 2 Butts, or 252 Gallons |        | 1 Tun                     |

## T I M E.

|                       |        |                     |
|-----------------------|--------|---------------------|
| 60 Seconds            | } Make | 1 Minute            |
| 60 Minutes            |        | 1 Hour              |
| 24 Hours              |        | 1 Day Natural       |
| 7 Days                |        | 1 Week              |
| 4 Weeks               |        | 1 Month             |
| 12 Months and one Day |        | 1 Year, or 365 Days |

Sometimes a Fraction is expressed Decimally; and in this Case an Unit is supposed to be divided into 10 Parts; and every one of those 10 Parts, into other 10 Parts; whereby Unity is divided into 100 Parts. Again, every of those Parts are supposed to be divided into other 10 Parts, and then Unity is divided into 1000 Parts; and so as far as you please.

In any Decimal Fraction, the Denominator is not expressed, but understood; and the Numerator hath a Point, or Comma, prefixed, to distinguish it from an Integer.

So if a Pound be divided into 10 Parts, 10 Shillings, or  $\frac{1}{10}$ , will be thus expressed,  $\frac{1}{10}$ , or thus, .5.

Again, if a Pound Sterling be divided into 100 Parts, 5 Shillings, or  $\frac{1}{4}$  of a Pound, will be expressed thus,  $\frac{25}{100}$ , or .25.



## The INTRODUCTION. II

Thus you see the Denominator of a Decimal Fraction may very well be omitted, because easily known, being always an Unit with as many Cyphers annexed as there are Places in the Numerator.

*Note also,* That Cyphers placed to the Left-hand of an Integral Number, or to the Right-hand of a Decimal, neither increase nor decrease the Value; but placed contrary, work contrary Effects; for as Cyphers placed to the Right-Hand of an Integer, increase the Value in a tenfold Proportion; so Cyphers placed to the Left-hand of a Decimal Fraction, decrease the Value in the same Proportion.

So 5 Pounds, by annexing a Cypher to the Right-hand, becomes 50 Pounds, ten times more than before; So 5  $\frac{1}{10}$  or 10 s. by annexing a Cypher to the Left-hand, become .05, or 1 Shilling, ten times less than before. But more of this in Decimal Arithmetick.



Thus you see the Denominator of a Decimal Fraction may very well be omitted, because easily known, being always an Unit with as many Cyphers annexed as there are Places in the Numerator.

# *An Explanation of certain CHARACTERS or SIGNS made use of in this Work.*

**+** PLUS, or more, the Sign of *Addition*; and, when placed between two Numbers, signifies that they are to be added together; as  $5+6$  denotes, that 5 and 6 are to be added into one Sum.

**—** Minus, or less, the Sign of *Subtraction*; and, when it stands between two Numbers, denotes that the latter is to be subtracted from the former; as  $7-3$ , is 7 less 3, and signifies that 3 is to be subtracted from 7.

**×** Is the Sign of *Multiplication*, and signifies, when placed between two Numbers, that they are to be multiplied together: Thus  $2 \times 3$  is 2 multiplied by 3.

**÷** Is the Mark of *Division*; and signifies, when two Numbers are placed one above another, that the Number above is to be divided by that below: As  $\frac{6}{2}$  or  $6 \div 2$ , denote that 6 is to be divided by 2.

**=** The Sign of *Equality*; and, when placed between two numerical Expressions, denotes that they are equal between themselves: As  $7+3=8+2$ . That is, the Sum of 7 and 3 is equal to the Sum of 8 and 2.

**:** Implies to, and **::** so is. They are Marks of *Proportionality*, signifying that the Numbers between which they are placed are proportional: As  $2:4::8:16$ , signifies, as 2 to 4 so is 8 to 16.

## NUMERATION.

**B**Y Numeration we know how to place, or give a just Value to, any Number propounded; which that you may do, observe the Nature of the following Table.

The TABLE.

| Hundreds of Millions | Tens of Millions | Millions | Hundreds of Thous. | Tens of Thous. | Thousands | Hundreds | Tens | Units |
|----------------------|------------------|----------|--------------------|----------------|-----------|----------|------|-------|
|                      |                  |          |                    |                |           |          |      | 1     |
|                      |                  |          |                    |                |           |          | 2    | 1     |
|                      |                  |          |                    |                |           | 3        | 2    | 1     |
|                      |                  |          |                    | 4              | 3         | 2        | 1    |       |
|                      |                  |          | 5                  | 4              | 3         | 2        | 1    |       |
|                      |                  |          | 6                  | 5              | 4         | 3        | 2    | 1     |
|                      |                  | 7        | 6                  | 5              | 4         | 3        | 2    | 1     |
|                      | 8                | 7        | 6                  | 5              | 4         | 3        | 2    | 1     |
| 9                    | 8                | 7        | 6                  | 5              | 4         | 3        | 2    | 1     |

In the foregoing Table you may see how each Place exceeds the former ten Times, increasing in Value towards the Left-hand.

The first Place is the Place of Units, the second Tens, the third Hundreds, the fourth Thousands; and so on as far as you please.

The Denomination of the first Period, or of the first 3 Places, is Hundreds; the Denomination of the second Period, or of the second 3 Places, is Thousands, of the third, is Millions.

The fourth Period, if it had been annexed, would have been Thousands of Millions; but in Practice we have seldom Use for so large a Number.



In reading the Numbers, it is convenient that the young Learner should exercise himself in the smallest first, and so proceed to the greater, 'till he be perfect.

The Value of 7654321, being the 7th Number in the Table, will be found to be in Words at length, seven Millions, six hundred fifty-four Thousand, three Hundred, Twenty-one. Of the fourth, to wit of 4321, the Value in Words at length will be, four Thousand, three Hundred, Twenty-one; and so of any other.

And though the former Table go but to 9 Places, yet it is sufficient to find the Value of any Number, though it consist of 90 thousand Places.

A ready way in long Numbers, is pointing the Places of Millions, as in the Number underneath.

| M. of M. of M. of M. | Mill. of Mill. of Mill. | Millions of Millions | Millions |
|----------------------|-------------------------|----------------------|----------|
| 7                    | 6                       | 5                    | 4        |
| 3                    | 2                       | 3                    | 4        |
| 2                    | 3                       | 4                    | 5        |
| 1                    | 4                       | 5                    | 6        |
|                      | 5                       | 6                    | 7        |
|                      | 6                       | 7                    | 8        |
|                      | 7                       | 8                    | 9        |
|                      | 8                       | 9                    | 1        |
|                      | 9                       | 1                    | 2        |

## ADDITION.

**A**DDITION is the Gathering together of several Numbers into one Total Sum.

### Addition of INTEGERS.

Take care to place Units under Units, Tens under Tens, &c. And for every 10, carry one to the next Place.

## Addition of INTEGERS.

15

### Example.

To work this Example, I begin in the Units Place, and say, 7 and 4 is 11, and 6 is 17; place 7 under the place of Units, and for the Ten carry 1 to the next place; then going to the place of Tens, I say, 1 that I carried and 6 is 7, and 7 is 14, and 1 is 15; set down 5, and carry 1; then 1 I carried and 9 is 10, and 9 is 19, and 2 is 21; set down 1, and carry 2; then 2 I carried and 2 is 4, and 2 is 6, and 4 is 10, which being the last, set it all down, and the Total Sum will be 10157, as in the Example may be seen.

4216  
 2974  
 2967  


---

 10157 Total

### Other Examples for Practice.

|          |       |
|----------|-------|
| 46725632 | 41262 |
| 12981624 | 12346 |
| 37890167 | 71621 |
| 34256782 | 32423 |
| 42167142 | 4216  |
| 46300001 | 2194  |
| 29067892 | 2651  |
|          | 3986  |
|          | 7894  |
|          | 6724  |
|          | 167   |
|          | 729   |
|          | 814   |
|          | 672   |
|          | 500   |
|          | 27    |
|          | 42    |
|          | 61    |
|          | 7     |

### Addition of MONEY.

In Addition of Numbers of divers Denominations, as Money, Weight, Measure, &c;

We shall first begin with Money, that being the most common.

C 2

Having

Having placed the Numbers given to be added, in their Order, (*viz.*) Pounds under Pounds, Shillings under Shillings, Pence under Pence, &c.

Then,

For every 4 Farthings carry one Penny, for 12 Pence carry one Shilling, and for 20 Shillings carry one Pound.

*Example.*

Begin with the Farthings, and say, 2 *l.* *s.* *d.* *q.*  
and 2 is 4, and 3 is 7, and 1 is 8 Farthings, 21 12 7 1  
set down a Cypher, and carry two Pence 36 15 8 3  
to the place of Pence; then two I carried 14 12 7 2  
and 2 is 4, and 7 is 11, and 8 is 19, and 18 15 2 2  
7 is 26 Pence; set down 2, and carry 2 Shillings; then 2 I carried and 5 is 7, 91 16 2 0  
and 2 is 9, and 5 is 14, and 2 is 16; set down 6 Shillings and carry 1 Angel,  
which with the other 4 Angels make 5 Angels; set down  
1 Angel and carry 2 *l.* Then in Pounds work as in Integers, and the Sum will be 91 *l.* 16 *s.* 2 *d.* 0 *q.*

*Other Examples for Practice.*

| <i>l.</i> | <i>s.</i> | <i>d.</i> | <i>q.</i> |
|-----------|-----------|-----------|-----------|
| 42        | 16        | 9         | 1         |
| 36        | 18        | 2         | 1         |
| 34        | 17        | 9         | 2         |
| 16        | 16        | 8         | 1         |
| 74        | 17        | 7         | 3         |
| 18        | 12        | 5         | 1         |
| <hr/>     |           |           |           |
| 224       | 19        | 6         | 1         |

| <i>s.</i> | <i>d.</i>       |
|-----------|-----------------|
| 17        | 9 $\frac{1}{2}$ |
| 12        | 7 $\frac{1}{2}$ |
| 13        | 9 $\frac{1}{4}$ |
| 7         | 2 $\frac{1}{4}$ |
| <hr/>     |                 |
| 2         | 11 5 0          |

| <i>l.</i> | <i>s.</i> | <i>d.</i> | <i>q.</i> |
|-----------|-----------|-----------|-----------|
| 365       | 16        | 8         | 1         |
| 321       | 12        | 5         | 2         |
| 178       | 18        | 8         | 3         |
| 641       | 12        | 5         | 1         |
| 129       | 13        | 6         | 3         |
| 421       | 12        | 7         | 1         |
| 624       | 13        | 8         | 3         |
| 424       | 12        | 7         | 1         |
| 100       | 00        | 0         | 0         |
| 724       | 16        | 0         | 3         |
| 146       | 17        | 10        | 1         |
| 741       | 18        | 8         | 2         |
| 178       | 12        | 3         | 2         |
| 246       | 16        | 8         | 2         |
| 146       | 17        | 11        | 3         |
| 424       | 12        | 5         | 0         |
| 129       | 18        | 8         | 0         |
| <hr/>     |           |           |           |
| 5949      | 03        | 6         | 0         |

If



## Addition of WEIGHT. 17

If your Sum be long, you may point it, or divide it into Parts; and the Parts added together will be equal to the Whole, which proves the Work.

### Addition of Troy-Weight.

Having placed your Numbers in order, that is, each under its own Denomination; then, for every 24 Grains, carry one Penny-weight, for 20 Penny-weights carry one Ounce, for 12 Ounces carry one Pound.

#### Example.

|                                          |                 |
|------------------------------------------|-----------------|
| Begin with the Grains, and say, 12 Gr.   | lb. ou. pw. gr. |
| and 13 is 25, and 15 is 40, which is one | 24 7 11 15      |
| Penny-weight and 16 Grains; set down     | 36 5 15 13      |
| 16 Grains, and carry one Penny-weight    | 64 2 14 12      |
| to the Place of Penny-weights: In        | <hr/>           |
| Penny-weights work as in Shillings; in   | 125 4 01 16     |
| the Ounces work as in Pence; and in      | <hr/>           |
| the Pounds as in Integers, and the Total |                 |
| will be 125 lb. 4 ou. 1 pw. 16 gr.       |                 |

#### Other Examples.

| lb. ou. pw. gr. | lb. ou. pw. gr. |
|-----------------|-----------------|
| 364 7 17 11     | 4216 7 10 19    |
| 142 8 18 10     | 1216 5 7 05     |
| 219 6 10 14     | 7146 8 11 16    |
| 216 7 12 10     | 2162 5 13 10    |
| <hr/>           | <hr/>           |
| 943 6 18 21     | 14742 3 03 02   |
| <hr/>           | <hr/>           |

### Addition of Averdupois-Weight.

Having placed your Numbers in their true Places; for 16 Drains carry one Ounce, for 16 Ounces carry one Pound, for 28 Pounds carry one Quarter, for 4 Quarters carry one Hundred Weight.

Begin

Example.

Begin with the Ounces, and say, 10 C. q. lb. ou.  
 Ounces and 5 is 15, and 8 is 23; set 36 2 11 8  
 down 7 Ounces, and carry 1 Pound to 14 1 17 5  
 the Pounds; then 1 Pound I carried 64 2 13 10  
 and 13 is 14, and 17 is 31, and 11 is  
 42 Pounds, which is 1 Quarter and 14 115 2 14 7  
 Pounds; set down 14 and carry 1 Quar-  
 ter. In the Quarters work as in the  
 Farthings, and in the Hundreds as in Integers, and the  
 Sum will be found to be, 115 C. 2 q. 14 lb. 7 ou.

Other Examples.

| lb.   | ou. | dr. | C.    | q. | lb. | ou. |
|-------|-----|-----|-------|----|-----|-----|
| 71    | 11  | 10  | 142   | 2  | 11  | 7   |
| 36    | 8   | 12  | 678   | 1  | 14  | 10  |
| 14    | 5   | 10  | 241   | 2  | 19  | 8   |
| 36    | 5   | 6   | 362   | 3  | 10  | 5   |
| 14    | 7   | 5   | 176   | 1  | 15  | 6   |
| <hr/> |     |     | <hr/> |    |     |     |
| 173   | 6   | 11  | 1601  | 3  | 15  | 4   |
| <hr/> |     |     | <hr/> |    |     |     |

There are other Weights and Measures: But he that understands these, cannot be ignorant of any other: If he but take notice of the Tables of Weights and Measures, in the Introduction, where he may see how much of one Denomination makes one of another; then the Work will be easy enough.

We shall therefore shew the Learner the Proof of Addition, and so conclude this Rule.

## Proof of ADDITION.

In *Proof of Addition*, add your Numbers downward, contrary to the common Way, carrying as usually; so will you avoid making a Mistake in the same Place: If the Total Sum be the same both Ways, you are right, else not.

Example.

Example.

| In Money. |    |    | In Averdupois wt. |    |     |     |
|-----------|----|----|-------------------|----|-----|-----|
| l.        | s. | d. | C.                | q. | lb. | ou. |
| 146       | 7  | 9  | 142               | 2  | 11  | 6   |
| 362       | 14 | 2  | 178               | 1  | 19  | 10  |
| 174       | 11 | 5  | 242               | 2  | 18  | 5   |
| <hr/>     |    |    | <hr/>             |    |     |     |
| Sum 683   | 13 | 4  | Sum 990           | 2  | 04  | 10  |
| <hr/>     |    |    | <hr/>             |    |     |     |
| Proof 683 | 13 | 4  | Proof 990         | 2  | 04  | 10  |
| <hr/>     |    |    | <hr/>             |    |     |     |

Questions in ADDITION.

A Man at *Manchester* demands how far to *London*; and was answered, from hence to *Derby* is 38 Miles, thence to *Harborough* 32 Miles, thence to *St. Albans* 46 Miles, and so to *London* 20 Miles.

What is the Distance from *Manchester* to *London*?

38  
32  
Facit 136, as in the Work. 46  
20  
—  
136  
—

An old Man's Age was required, and he answered 20  
I have 5 Sons and 3 Daughters; betwixt the Birth of 12  
each of my Sons was 2 Years; betwixt my last Son 2  
and first Daughter, 4 Years; and 4 Years apiece be- 2  
twixt the rest of my Daughters; in my 20th Year 2  
was my first Son born, and that is the Age of my 4  
youngest Daughter 4

What is the Father's Age?

Answer, Sixty Years.

4  
4  
20  
—  
60  
—

S U B-



## SUBTRACTION.

**B**Y *Subtraction* we find the *Difference* of any two Numbers, by taking or drawing the lesser from the greater, whereby the *Difference* will appear.

### *Subtraction in INTEGERS.*

Take care to place Units under Units, Tens under Tens; and in case of Want, in Subtracting, borrow 10, and for every 10 so borrowed, pay one in the next Place.

### EXAMPLE.

Bought 7126 Bundles of Yarn, of which I have sold 1693 out again. What remains to sell?

Place your Numbers as in the Margin, Bought 7126 and beginning at the Right-hand, say, 3 Sold 1693 from 6 and there remains 3, 9 from 2 I cannot, but 9 from 12 (for borrowing 10 Rest 5433 makes the 2 12) rest 3; then go on, saying, 1 I borrowed and 6 is 7, from 1 I cannot, but 7 from 11, rest 4; lastly, 1 I borrowed and 1 is 2 from 7, rest 5: So will the Remain be found 5433, as in the Work.

### *Other Examples for Practice.*

Lent 467256  
Paid 414063

From 67254246  
Subt. 6109826

Lent

## Subtraction of MONEY.

21

Lent at one time 4246462 l.

at another 124216

at another 62142

at another 4215

Lent in all 4437035

Paid at one time 1262125

at another 642162

at another 82425

Paid in all 1987712

Rest to pay 2449323

In this last Example I add the Sums lent into one Sum, and likewise what was paid; then subtracting as before, the Remainder will be found to be 2449323.

## Subtraction in MONEY.

In Subtraction of Numbers of diverse Denominations, we shall, as in *Addition*, begin with Money in the first Place, and of the rest in their Order.

*Subtraction in Money* is not much different from *Integers*; only Note, That having placed your Numbers right, the Less under the Greater, and Pounds under Pounds, Shillings under Shillings, &c. you must in case of Want in the Farthings, borrow 4, or one Penny; and in the Pence borrow 12, or one Shilling; and in the Shillings, borrow 20 Shillings, or one Pound, remembering always to pay what you borrowed to the next Place, by calling the lower Figure one more than it is.

D

EXAM-

## Subtraction of MONEY.

## EXAMPLE.

Begin with the Farthings and say, 2 Farthings from 1 I cannot, but 2 from 4, rest 2, and 1 is 3, which set down; then go to the Pence, saying 1 I borrowed and 9 is 10, from 7 I cannot, but 10 from 12 rest 2, and 7 is 9 Pence, which set down; then proceed to the Shillings, say 1 Shilling I borrowed and 14 is 15, from 12 I cannot, but from 20, rest 5, and 12 is 17, which set down; and going to the Pounds, work as in Integers, and the Remain will be 48 l. 17 s. 9 d. 3 q.

|      | l. | s. | d. | q. |
|------|----|----|----|----|
| Lent | 67 | 12 | 07 | 01 |
| Paid | 18 | 14 | 09 | 02 |
| Rest | 48 | 17 | 09 | 03 |

## Other Examples for Practice.

|      | l.  | s. | d. | q. |
|------|-----|----|----|----|
| Lent | 142 | 16 | 9  | 1  |
| Paid | 79  | 13 | 8  | 2  |

|      | l.  | s. | d. |
|------|-----|----|----|
| Lent | 416 | 16 | 7  |
| Paid | 198 | 14 | 2  |

Lent at several times

|      | l.  | s. | d. |
|------|-----|----|----|
|      | 21  | 14 | 9  |
|      | 36  | 18 | 2  |
|      | 14  | 17 | 3  |
|      | 91  | 14 | 6  |
|      | 71  | 12 | 8  |
|      | 83  | 16 | 7  |
|      | 14  | 14 | 2  |
| Paid | 333 | 12 | 5½ |

Rest to pay



## Subtraction of TROY-WEIGHT. 23

### Subtraction of TROY-WEIGHT.

In *Subtraction of Troy-Weight*, in case of Want in the Grains, borrow 24, in the Penny-Weights 20, in the Ounces 12, and in the Pounds as in Integers, remembering still to pay what you borrow to the next Place.

Begin with the Grains, and say 16 Grains from 14 Grains I cannot, but 16 from 24, rest, 8, and 14 is 22, which set down; then proceeding to the Penny-weights, there you may work as in Shillings, and in the Ounces as in Pence, and in the Pounds as in Integers.

### Other Examples.

|        | lb. | ou. | pw. | gr. |        | lb.  | ou. | pw. | gr. |
|--------|-----|-----|-----|-----|--------|------|-----|-----|-----|
| Bought | 674 | 07  | 04  | 10  | Bought | 4216 | 05  | 07  | 11  |
| Sold   | 194 | 08  | 11  | 06  | Sold   | 1882 | 08  | 10  | 14  |
| Rest   |     |     |     |     | Rest   |      |     |     |     |

### Subtraction of AVERDUPON-WEIGHT.

Having placed your Numbers in Order, as was intimated before, subtract as usually; but in case of Want in the Drams or Ounces borrow 16, in the Pounds 28, in the Quarters 4, and in the Hundreds as in Integers.

Begin with the Ounces, and say, 8 Ounces from 5 Ounces I cannot, but 8 from 16 rest 8, and 5 is 13, which set down; then 11 borrowed and 10 is 11, which subtracted from 11 rest 0, which set down; then proceed to the Quarters, where work as in Farthings, and in the C's work as in Integers.

# **Proof of SUBTRACTION.**

## *Other Examples.*

|        | C.  | q. | lb. | oz. |        | C.  | q. | lb. | oz. |
|--------|-----|----|-----|-----|--------|-----|----|-----|-----|
| Bought | 420 | 2  | 19  |     | Bought | 144 | 2  | 14  | 05  |
| Sold   | 198 | 3  | 25  |     | Sold   | 79  | 3  | 19  | 10  |
| Rest   |     |    |     |     | Rest   |     |    |     |     |

## **Proof of SUBTRACTION.**

To prove Subtraction, do thus; Add the Sum to be subtracted to the Remainder, the Total will be equal to the Number from which you were to subtract, if your Work be right.

## *Example in Money.*

|       | l. | s. | d. |  |
|-------|----|----|----|--|
| Lent  | 42 | 16 | 09 |  |
| Paid  | 18 | 16 | 11 |  |
| Rest  | 23 | 19 | 10 |  |
| Proof | 42 | 16 | 09 |  |

## *In Troy-Weight.*

|        | lb. | oz. | pw. | gr. |  |
|--------|-----|-----|-----|-----|--|
| Bought | 142 | 12  | 11  | 14  |  |
| Sold   | 79  | 08  | 15  | 17  |  |
| Rest   | 63  | 03  | 15  | 21  |  |
| Proof  | 142 | 12  | 11  | 14  |  |

# Questions in SUBTRACTION. 25

A Bond dated in the Year 1685, How many Years are spent this present 1760?

From 1760

Subtr. 1685

Rest 75

The Author hereof was born in the Year of our Lord 1660, How old would he have been this present Year 1760?

From 1760

Subtr. 1660

Rest 100 Years, the Answer.

What Number of Pounds, Shillings and Pence, added to 34 l. 16 s. 9 d. 1 q. will make 100 l.?

|           | l. | s. | d. | q. |
|-----------|----|----|----|----|
| From 100  | 00 | 00 | 00 | 00 |
| Subtr. 34 | 16 | 09 | 10 |    |

65 03 02 03 The Answer.



MUL-



## MULTIPLICATION.

**B**Y *Multiplication*, we Increase or Multiply one Number by another, as oft as there are Units in either of the Numbers, and it ought to be perfectly understood by the Learner, who would know any thing of Arithmetick; Thousands of Questions in a great many Parts of the Mathematicks being resolv'd thereby.

In Multiplication are three Numbers or Members to be well taken Notice of.

*First*, The Multiplicand, or Number to be multiplied.

*Secondly*, The Multiplier, or Number by which we multiply.

*Thirdly*, The Product, or the Number proceeding, or produced from both.

In Multiplication it holds,  
As an Unit: To the Multiplier ::  
So is the Multiplicand: To the Product.

So if one Yard cost 5 Shillings, what will 64 Yards cost?

Here one Yard bears such Proportion to 5 Shillings, as 64 Yards will bear to the Product.

To work this Question, place your Numbers in Order; as in the Example following.

|        |     |                 |
|--------|-----|-----------------|
| Yd.    | s.  | Yds.            |
| If 1 : | 5 : | 64 Multiplicand |
|        |     | 5 Multiplier.   |

---

Product      320 *Facit* 320 Shillings, or 16 Pounds.

Here I multiply 64 by 5, saying 5 times 4 is 20, set down a Cypher and carry 2; then 5 times 6 is 30 and 2 I carried is 32; which set down to the Left-hand, the Cypher makes the Sum 320 for the Product: And so many Shillings will 64 Yards cost, at 5 Shillings the Yard.

But

## Multiplication of INTEGERS. 27

But before we proceed any farther, it will be convenient to give you a Table of Multiplication, which the Learner ought to get perfectly by Heart.

*A Table of MULTIPLICATION.*

| 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9   | 12  |
|----|----|----|----|----|----|----|----|-----|-----|
| 2  | 4  | 6  | 8  | 10 | 12 | 14 | 16 | 18  | 24  |
| 3  | 6  | 9  | 12 | 15 | 18 | 21 | 24 | 27  | 36  |
| 4  | 8  | 12 | 16 | 20 | 24 | 28 | 32 | 36  | 48  |
| 5  | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45  | 60  |
| 6  | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54  | 72  |
| 7  | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63  | 84  |
| 8  | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72  | 96  |
| 9  | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81  | 108 |
| 12 | 24 | 36 | 48 | 60 | 72 | 84 | 96 | 108 | 144 |

The foregoing Table contains the Multiplication of the 9 Digits, one by another, or by themselves, to which we have added a Column of 12 by the Digits, for the usefulness thereof; the reading whereof is easy; for suppose the Product of 7 by 9 were required, look for a Number at the Top, as suppose 9, and the other, to wit 7, in the Side, and in the Angle or Meeting is 63, the Product required; so 8 times 6 will be 48; look 8 in the Top, and 6 in the Side, and in the Angle of Meeting, you will find 48, and so of any other.

In *Multiplication* it mattereth not which of the Numbers is made the Multiplicand, or whether the Multiplier; for the Product is the same.

Only 'tis more convenient to make the less the Multiplier, and then proceed to the Work by the following Rule:

*First*, Set down the greater Number, and under it the Less, Units being under Units, Tens under Tens; then drawing a Line under them, begin with the first Figure of the Multiplier towards the Right-hand, and by it multiply each Figure of the Multiplicand, observing for every  
Ten

## 28 *Multiplication of INTEGERS.*

Ten to carry one to the next Place; then proceed to the second Figure of your Multiplier, doing as before, only you must place your Product a Figure nearer to the Left-hand, and so proceed to every Figure, doing as before, and removing every Product a Place nearer to the Left-hand; then drawing a Line under them, add them as they stand, and you will have the true Product, which may better be understood by observing the Work of the following Examples.

### *Example the First.*

By one Figure.

Mul. 1728 Multiplicand.  
by 7 Multiplier.

Having placed your Numbers as in the Margin, say 7 times 8 is 56, set down 6 and carry 5; then 7 times 2 is 14 and 5 is 19, set down 9 and carry 1; then 7 times 7 is 49 and 1 I carried is 50, set down a Cypher and carry 5; then 7 times 1 is 7 and 5 I carried is 12, which set down, and the Product is 12096.

This Question is the same as if one had demanded  
In 1728 Weeks, how many Days?  
Or in 1728 Lancashire Perches, how many Yards?  
Or, in 7 Foot of Timber, how many solid Inches?  
The Answer would have been alike in all.

### *Example the Second.*

By two Figures.

Multiply 3421 Multiplicand.  
by 36 Multiplier.

First say, 6 times 1 is 6, which set down; then 6 times 2 is 12, set down 2 and carry 1; then 6 times 4 is 24 and 1 is 25, set down 5, and carry 2; then 6 times 3 is 18 and 2 is 20, which set down; then beginning with the 2d Figure of the Multiplier, say 3 times 1 is 3, which set down under the second Figure from the Right-hand;



# Multiplication of INTEGERS. 29

hand; then 3 times 2 is 6, which set down; then 3 times 4 is 12, set down 2, carry 1; then 3 times 3 is 9 and 1 is 10, which set down, and your Multiplication is finished. But now you must add the two Products as they stand, as before taught in Addition of Integers, and the Sum is the true Product, to wit, 123156. When you had multiplied by 6, instead of multiplying by 3, you might have taken half the Product of 6, setting it one Place nearer the Left-hand, as you may see. This Question is the same as if one should ask in 3421 Yards, how many Inches?

## Example the Third.

By 3 Figures.

Multiply 1642 Multiplier.

by 231 Multiplier.

First say, once 2 is 2, once 4 is 4, once 6 is 6, once 1 is 1. Secondly, 3 times 2 is 6, 3 times 4 is 12, set down 2, carry 1; and 3 times 6 is 18, and 1 carried is 19, set down 9 and carry 1; then 3 times 1 is 3 and 1 is 4. Then begin with the last Figure, and say, 2 times 2 is 4, and 2 times 4 is 8, and 2 times 6 is 12, go 2, lastly, 2 times 1 is 2 and 1 is 3. These three Products placed and added as in the Example, give 379302 for the true Product.

This Question is the same as if one should ask, In 1642 Gallons of Wine, how many solid Inches?

These Examples being understood, it will be needless to explain any more; only take two or three for Practice.

## Other Examples for Practice.

(L. Mult. by

41265  
1728  
330120  
82530  
288835  
41265

And (II.)

462725  
2007

3239075  
925450  
928689075 Prod.

71305910 Prod.

E

(III.)

# **Multiplication of INTEGERS.**

(III.) *Mult.*  $\begin{array}{r} 46725 \\ \times 2400 \\ \hline 18690000 \\ 93450 \\ \hline 112140000 \end{array}$  And (IV.)  $\begin{array}{r} 123456 \\ \times 1000 \\ \hline 123456000 \end{array}$   
*Prod.*  $\begin{array}{r} 112140000 \\ 123456000 \end{array}$

In the second Example, I contracted my Work by omitting the Cyphers, only keeping their places vacant.

In the third Example, I multiplied by 24, adding two Cyphers to the Product.

In the fourth Example, I added three Cyphers to the Multiplicand, for 1 neither Multiplies nor Divides; and so of any other.

Multiplication may be performed without any Charge to the Memory, by setting down the whole Product of the Multiplication of every single Figure, whereby the Carriage of the Tens will be saved; but the Trouble of Addition will be the greater, as in the Work of the following Examples will be manifest.

## **EXAMPLE I.**

Let it be required to multiply  $7825$  by  $7$ .

First,  $7$  times  $5$  is  $35$ , which set down; then  $7$  times  $2$  is  $14$ , which set down,  $1$  before  $3$  and  $4$  under it, and  $7$  times  $8$  is  $56$ , set  $5$  before  $1$ , and  $6$  under it. Lastly,  $7$  times  $7$  is  $49$ , set  $4$  before  $5$ , and  $9$  under it, as may be seen in the Work; which Numbers added as they stand, will be the true Product, which may be proved as in the common Way.

$\begin{array}{r} 7825 \\ \times 7 \\ \hline 54775 \end{array}$   
*Multiply by*  
*Prod.*  $54775$

# Multiplication of INTEGERS. 31

## EXAMPLE II.

The Work in this is the same as the last, only it is three times repeated; and when the Product of any Figure will not make 10, place a Cypher in the Place, where, if it had made 10 or above, the Figure above 10 must have stood, which may be seen in the Work itself; so we will not trouble ourselves, or the Learner, with any more Explanation.

$$\begin{array}{r}
 \text{Multiply} \quad 4215 \\
 \text{By} \quad 879 \\
 \hline
 37935 \\
 29595 \\
 33720 \\
 \hline
 3704985
 \end{array}$$

## PROOF.

$$\begin{array}{r}
 \text{Multiply} \quad 4215 \\
 \text{By} \quad 879 \\
 \hline
 37935 \\
 29595 \\
 33720 \\
 \hline
 3704985
 \end{array}$$

## Multiplication of diverse DENOMINATIONS.

Before we make an End of *Multiplication*, it will be convenient to say something concerning *Multiplication* of Numbers of diverse Denominations. And first, when one is of diverse Denominations, and the other an Integer.

## EXAMPLE I.

If a Pack of Yarn cost 13*l*. 17*s*. 9*d*. What will 5 Packs cost?

Begin first with the least Denomination, multiplying by the Integer, so proceeding from one Denomination to another, till you come to the greatest; carrying still from one Denomination the Parts belonging to the next greater.



### 32 Multiplication of diverse Denominations.

#### EXAMPLE I.

See the Work.

So in the Example, I say first, 5 times 9 Pence is 45 Pence, or 3 Shillings and 9 Pence, set down 9 Pence and carry 3 Shillings; then 5 times 7 Shillings is 35, and 3 Shillings is 38 Shillings; set down 8 Shillings and carry 3 Angels; then 5 times 1 Angel is 5 and 3 is 8 Angels, set down a Cypher, and carry 4 Pounds; then going to the Pounds, work as in Integers, saying 5 times 3 is 15, and 4 is 19, set down 9 and carry 1; then 5 times 1 is 5, and 1 I carried is 6; which set down as in the Work, and the Answer will be found to be 69 l. 08 s. 9 d.

#### EXAMPLE II.

If 1 C. of Tobacco cost 3 l. 15 s. 9 d. 1 q. What will 35 C. cost?

Here because it will be too tedious to multiply by 35 at once, I multiply by the Ratio's of 35; to wit, by 5 and 7, for 5 times 7 is 35.

Answer, 132 l. 11 s. 11 d. 3 q.

See the Work.

So in the Example, I multiply 3 l. 15 s. 9 d. 1 q. by 7, the Product is 26 l. 10 s. 4 d. 3 q. and this Product I multiply by 5, the Product will be as in the Example, 132 l. 11 s. 11 d. 3 q. which is the Answer to the Question.

132 11 11 3

#### EXAMPLE III.

At 12 s. 7 d. 1 q. the Gross, What will 78 Gross of Inle cost?

Because I cannot find two Numbers, which multiplied together make 78, I take two which will make as near 78 as possible; to wit, 9 and 8, which multiplied together, make 72, which wants 6 of 78. Then multiplying the

## Multiplication of diverse Denominations. 33

the first Number given by 6, adding the Product to the last Product before found, gives the Answer of the Question.

*See the Work.*

So, here I multiply 12 s. 7 d. 1 q.  
by 9, first, and that Product, to wit,  
5 l. 13 s. 5 d. 1 q. I multiply by 8,  
which make 45 l. 7 s. 6 d. and to this  
I add the Product of 12 s. 7 d. 1 q.  
multiplied by 6, to wit, 3 l. 15 s. 7 d. 1 q.  
2 q. and the Sum is 49 l. 03 s. 12 d. 2 q.  
the Answer.

|       |    |     |
|-------|----|-----|
| 12    | 07 | 1   |
| <hr/> |    |     |
| 5     | 13 | 195 |
| <hr/> |    |     |
| 45    | 07 | 06  |
| <hr/> |    |     |
| 3     | 15 | 07  |
| <hr/> |    |     |
| 49    | 03 | 01  |
| <hr/> |    |     |

### E P A M P L E IV.

At 6 l. 12 s. 5 d. the Bag, what will 80 Bags of Cotton cost?

*See the Work.*

First I multiply by 8, and that Product  
by 9, which makes 72, which wants 8  
of 80; and seeing the first Product was  
the Number given, multiplied by 8, I add  
the two Products together for the An-  
swer to the Question, which is 529 l. 13 s.  
4 d.

|       |    |   |
|-------|----|---|
| 6     | 12 | 5 |
| <hr/> |    |   |
| 52    | 19 | 4 |
| <hr/> |    |   |
| 476   | 14 | 0 |
| <hr/> |    |   |
| 529   | 13 | 4 |
| <hr/> |    |   |

This Example might have been wrought as under, by  
multiplying by 9, and that Product by 9 again, which  
makes 81, too much by one; wherefore if from the last  
Product you subtract the first given Number, the Answer  
will be found as before.

\* Multiply by 8, and that Product by 10, gives the An-  
swer 529 l. 13 s. 4 d. much shorter and easier; and will  
for any Number from 20 to 120 arising by Tens, to mul-  
tiply by the Figures, and then that Product by 10.

Take an Example where both Numbers are of diverse  
Denominations, but of contrary Kinds.

E X-

### 34 Multiplication of diverse Denominations

the first Number given by adding the Product to the last Product before found the sum of the Quotient

#### EXAMPLE V.

At 3*l.* 14*s.* 5*d.* the C. what will 36 C. 2*q.* 14*l.* cost?

See the Work.

|                                                                                                                                                                                       | <i>l.</i> | <i>s.</i> | <i>d.</i> | <i>q.</i>     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|-----------|---------------|
| 36 C. 2 <i>q.</i> 14 <i>l.</i>                                                                                                                                                        | 3         | 14        | 05        |               |
|                                                                                                                                                                                       |           |           | 9         |               |
| First I Multiplied by 9, and that Product by 4, which makes 36;                                                                                                                       | 33        | 09        | 09        |               |
| then for the $\frac{1}{2}$ C. I took $\frac{1}{2}$ the first Number, which is the Price of one Hundred; and for the 14 <i>lb.</i> I took the 4th Part of the $\frac{1}{2}$ C. which 3 | 133       | 19        | 00        |               |
| Numbers added together make                                                                                                                                                           | 1         | 17        | 02        | 2             |
| 136 <i>l.</i> 5 <i>s.</i> 6 <i>d.</i> 0 <i>q.</i> $\frac{1}{2}$                                                                                                                       |           |           | 09        | 03            |
|                                                                                                                                                                                       |           |           |           | 2             |
|                                                                                                                                                                                       |           |           |           | $\frac{1}{2}$ |
|                                                                                                                                                                                       | 136       | 05        | 06        | 0             |
|                                                                                                                                                                                       |           |           |           | $\frac{1}{2}$ |

When both are of unlike Denominations, but of the same kind, as Pounds, Shillings and Pence, by Pounds, Shillings and Pence, you must take good Notice of the following Directions.

- First, Pounds, multiplied by Pounds, produce Pounds.
- Secondly, Pounds multiplied by Shillings, every 20 is one Pound, the rest Shillings.
- Thirdly, Pounds multiplied by Pence, every 12 is one Shilling, the rest Pence.
- Fourthly, Shillings multiplied by Shillings, every 20 is 1 Shilling, every 5 is 3 Pence, and each 1 is 2 Farthings, and 4 tenth Parts of a Farthing.
- Fifthly, Shillings multiplied by Pence, every 5 is a Farthing, and each one 2 tenth Parts of a Farthing.
- Sixthly and Lastly, Pence multiplied by Pence, every 60 is a Farthing, and every 6 one tenth Part.

The Reason whereof is plain in the following Diagram.

Take an Example whereof the Numbers are of diverse Denominations, but of the same kind.

EXAMPLE VI.



# Multiplication of diverse Denominations. 35

Let there be two Numbers of three Denominations given, and let A F be the Square or Rectangle made of the greatest Denomination in both Numbers, E K and B G two Rectangles, made by Multiplying the 1st Denomination by the 2d, the Product divided by an Integer of the greatest Denomination reduced into the Parts of the 2d; the Quotient shall be of the same Denomination with the Greatest, and the Remainder of the same Denomination with the 2d.

2. F L is the Square of the 2d Denomination, which being Divided by an Integer of the greatest, reduced into the Parts of the 2d, the Quotient shall be of the same Denomination with the 2d, and if there be any Remainder, it must be multiplied by a Number, which, in the 3d Denomination is equal to an Integer in the 2d, the Quotient shall be of the 3d Denomination: And if there be yet a Remainder, it must be multiplied by a Number, which in the 4th Denomination is equal to an Integer in the 3d, and divided as before, the Quotient shall be of the 4th Denomination: and so forward till the Remainder cannot be reduced into lesser Terms. And thus we have done with the Square or Rectangle A C I L.

### 36 Multiplication of diverse Denominations.

3. CH and IO are two Rectangles made by the Multiplication of the Sum of the greatest Denomination given, by the Sum given, which is of the 3d inferior Denomination; the Product shall be of the same Denomination with the 3d; and therefore if that Product be greater than an Integer of the 2d Denomination, reduced into the Parts of the 3d; it must be divided by a Number, which in the 3d Denomination is equal to an Integer in the 2d; the Quotient shall be of the 2d Denomination, and the Remainder of the 3d.

4. G M and K P are two Rectangles made by multiplying the Sum of the 2d Denomination by the 3d, and the Product being divided by one of the Integers in the greatest Denomination, reduced into the Parts of the 2d, the Quotient shall be of the same Denomination with the 3d, and the Remainder must be multiplied by a Number which in the 4th Denomination is equal to an Integer; in the 3d the Quotient shall be of that 4th Denomination, and the Remainder shall be the Numerator of a Fraction, whose Denominator is that former Divisor.

5. *Lastly*, LQ is the Square of the 3d Denomination, which muſt be divided, if it may be, by one Integer or the greateſt Denomination, reduced into the Parts of the 3d, the Quotient ſhall be of the 4th Inferior Denomination, and the Remainder ſhall be the Numerator of a Fraction, whoſe Denominator is the ſame Diviſor.

This *Diagram* being well understood, the Multiplication of Pounds, Shillings and Pence, by Pounds, Shillings and Pence, will be easy; as may better be seen in the following Examples.

Following Examples:

Let it be required to Multiply  $3^1, 5^3, 6^4$ . By

And thus we have done with the Reduction into lesser Terms. And thus we have done with the Remainder: and to forward of the Remainder cannot be as before, the Quotient shall be of the 4th Denomination is equal to an Integer in the 3d, it will be multiplied by a hundred, which

See Square or Rectangle A CIL

## Multiplication of diverse Denominations. 27

*See the Work.*

First, I say, 2*l.* by 3 makes 6*l.* which set down.

Secondly, 2*l.* by 5*s.* is 10*s.* and 3*l.* by 12*s.* is 36*s.* whose Sum is 46*s.* which by Direction the 2*d.* will be 2*l.* 6*s.* which set down.

Thirdly, 2*l.* by 6*d.* is 12*d.* and 3*l.* by 9*d.* is 27*d.* whose Sum is 39*d.* which by Direction the 3*d.* will be 3*s.* 3*d.*

Fourthly, 12*s.* by 5*s.* is 60*s.* which by Direction the 4*th* will be 5*l.* 0*s.* 0*d.*

Fifthly, 12*s.* by 6*d.* is 72*d.* and 5*s.* by 9*d.* is 45*d.* whose Sum is 117*d.* which by Direction the 5*th* will be 5*d.* 3*q.* and 4 Tenth*s.* which set down.

Sixthly, and lastly, 6*d.* by 9*d.* is 54*d.* which by Direction the 6*th* will be 9 Tenth*s.* and adding all as they stand, the Sum will be the true Product; to wit, 8*l.* 12*s.* 9*d.* 0*q.* 3 Tenth*s.* as may be seen in the Work itself.

You may likewise observe by the way, that when I multiplied by contrary Denominations, I multiplied cross-wise both ways, which in the like Case the Learner is to take Notice of.

### EXAMPLE II.

Let it be required to multiply 2*s.* 6*d.* by 2*s.* 6*d.* one Pound being taken for the Integer.

2 Shillings by 2 Shillings makes 2*d.* 1*q.* 6 Tenth*s.*; then 2 Shillings by 6 Pence makes 12*d.* and 2 Shillings by 6 makes 12*d.* likewise; the Sum is 24*d.* equal to 1*d.* 0*q.* 8 Tenth*s.* Lastly, 6 Pence by 6 Pence makes 36*d.* equal to 6 Tenth*s.* which 3 Numbers added together, produce 3*d.* 3 Farthings for the true Product, and the Answer of the Question. Thus you see Fractions multiplied, become less in the same Proportion, as Integers by multiplying become greater.



### 38 Multiplication of diverse Denominations.

But if it were required to multiply 2s. 6d. by 2s. 6d. and making a Shilling the Integer, then the former Directions will not fit, but the Diagram holds for any.

But for this Case take the Directions following.

- I. Shillings by Shillings produce Shillings.
- II. Shill. by Pence, every 12 is a Shill. the rest Pence.
- III. Shill. by Farthings, each one is a Farthing.
- IV. Pence by Pence, every 12 is a Penny, and each 3 a Farthing.
- V. Pence by Farthings, each 12 is a Farthing, and every 3 is a Quarter of a Farthing.
- VI. Lastly, Farthings by Farthings, each 12 is a Quarter of a Farthing.

See the Work.

#### EXAMPLE III.

2 Shillings by 2s. makes 4 Shill. and 2s. by 6d. is 12, and 2s. by 6d. is 12, Sum is 24, which is 2 Shill. then 6d. by 6d. is 36 to 3d. So the Product will be 6 Shill. and 3d.

6 3

Whereby you may see the Value of your Product attereth according as you take your Integer.

These Directions will not only fit for this, but may very well serve for the measuring of Board, Glass, &c. For seeing a Foot is divided into 12 Inches, and every Inch into 4 Quarters; the same Directions will fit, if instead of Shillings, Pence and Farthings, you account Feet, Inches, and Quarters.

#### EXAMPLE IV.

A Piece of Waincot is 8 Foot 6 Inches and  $\frac{1}{2}$  long, and 2 Foot 9 Inches  $\frac{1}{2}$  broad. The Content of this Piece of Waincot is required.

Ans.

## Contractions in MULTIPLICATION. 39

*See the Work.*

*Answ.* 24 Feet, and something more, as in the Work.

These Rules will prove of excellent Use for those Persons that understand not Vulgar nor Decimal Fractions, in measuring superficial Measure.

$$\begin{array}{r}
 \text{f.} \quad \text{in.} \quad \text{q.} \\
 8 \quad 6 \quad 2 \\
 2 \quad 9 \quad 3 \\
 \hline
 16 \quad 7 \quad 0 \quad 4 \quad 2 \quad 3 \quad 0 \quad 1 \\
 24 \quad 00 \quad 1 \frac{1}{2}
 \end{array}$$

*The Ans.*

## Contractions in MULTIPLICATION.

The foregoing Examples being well considered, are sufficient for the Industrious Learner; we will here annex a Contraction or two, and conclude the Rule with some Practical Questions.

To multiply by an Unit with Cyphers, was shewn before, together with another Contraction or two, so we shall forbear those, and name some others.

1. And first, to multiply by 11 : 12 : 13, &c. at one Operation.

To multiply by 11, is but to set down the Multiplicand twice, the lower being removed one Place either towards the Right or Left-hand.

### EXAMPLE.

Multiply 4721 by 11, the Product will be 51931.

Place your Numbers thus, 4721 or thus 4721

$$\begin{array}{r}
 4721 \\
 4721 \\
 \hline
 \end{array}$$

*Prod.* 51931    *Prod.* 51931

To multiply by any of the rest, is no more but to multiply by 2, 3, 4, 5, &c. and as you multiply, to add that Figure of the Multiplicand which stands on the Right-hand.

F 2

EX.

## 48 Contractions in MULTIPLICATION.

### EXAMPLE.

Multiply 12345 by 13.

First, I say, 3 times 5 is 15, set down 5, carry 1, and 3 times 4 is 12, and 1 I carried is 13, and 5 on the Right-hand is 18, set down 8, and carry 1; then 3 times 3 is 9, and 1 I carried is 10, and 4 on the Right-hand is 14, set down 4, carry 1; then 3 times 2 is 6, and 1 I carried is 7, and 3 on the Right-hand is 10, set down 0, carry 1; and 3 times 1 is 3, and 1 I carried is 4, and 2 is 6, set down 6; and lastly annex 1, being the first Figure in your Multiplicand, and your Work is finished.

See the Work.

12345 Md.

13 Mr.

160485 Prod.

### Other Examples.

Mul. 6729004 Md.

Mul. 54321 Md.

by 19 Mr.

by 16 Mr.

127851076

869136

To multiply by 111, 112, 113, 114, 115, 116, &c. at one Operation.

To do which you must multiply by 1, 2, 3, 4, 5, &c. and as you multiply, add those two Figures of your Multiplicand which stand to the Right-hand.

### EXAMPLE.

Multiply 654321 by 115.

See the Work.

654321 Md.

115 Mr.

First, I say, 5 times 1 is 5, which set down; and 5 times 2 is 10, and 1 is 11, set down 1, carry 1; then 5 times 3 is 15, and 1 I carried is 16, and 2 on the Right-hand is 18, and 1 beyond that, is 19, set down 9, and carry 1; then 5 times 4 is 20, and 1 I carried is 21, and 3 on the Right-hand is 24,



## Contractions in MULTIPLICATION. 41

and 2 beyond that is 26, set down 6 and carry 2; then 5 times 5 is 25, and 2 is 27, and 4 on the Right-hand is 31, and 3 is 34, set down 4, carry 3; then 5 times 6 is 30, and 3 is 33, and 5 is 38, and 4 is 42, set down 2, carry 4, which 4 I add to 6, and that to 5, makes 15, set down 5, carry 1, which one added to the 6, makes 7, which set down as in the Work.

### Other Examples.

Mul. 4246 by 111; and 642341 by 119.

4246 Md.

642341 Md.

111 Mr.

119 Mr.

471306 Prod.

76438579 Prod.

3. To multiply by 101, 102, 103, 104, 105, 106, &c. is no more than to multiply by 1, 2, 3, 4, 5, &c. and as you multiply, add that Figure of your Multiplicand that standeth next the Right-hand, except one. As you may see in the Example.

Say, 6 times 1 is 6, which set down; and 6 times 2 is 12, set down 2, carry 1; then 6 times 3 is 18, and 1 is 19, and 1 which is the next but one to the Right-hand, is 20, set down 0, carry 2; then 6 times 4 is 24, and 2 I carried is 26, and 2 which is next but one, is 28, set down 8, carry 2, to which add the next but one, which is 3, makes 5, which set down; to which add 4, and your Work is finished: And the Product is 458026.

Mul. 4321 Md.  
by 106 Mr.

458026

### Other Examples.

Mul. 427005 Md.  
by 101 Mr.

43127505

And 604150  
by 109

65852350

Many

## 42 *Proof of MULTIPLICATION.*

Many more Contractions might be added, but these being sufficient, we shall desist, and speak something concerning the Proof of the Rule.

### *Proof of MULTIPLICATION.*

There are several Ways to prove Multiplication; but the only Proof is by Division; but that being not yet learned, we shall forbear that Way for the present.

Another Way mentioned by several Authors, is, by casting away the Nines, both in the Multiplicand, Multiplier, and Product. But this Way being erroneous, we shall mention it no farther.

A third Way, and that which we shall use at present, is by making Multiplication to prove itself, thus: Make that which was your Multiplicand your Multiplier; then multiplying as usual, if your Product be the same, your Work is right, else not.

### *E X A M P L E.*

Let it be required to multiply

By

1234 *Md.*

123 *Mr.*

3702

2468

1234

151782 *Prod.*

By the Work, I find the Product to be

151782.

To prove which Mul.

123 *Md.*

By

1234 *Mr.*

492

369

246

123

151782 *Prod.*

Here

## Questions in MULTIPLICATION. 43

Here you may see the Work is contrary, but the Product the same, which is the Proof of the Work, and thus of any other.

We shall here annex a Question or two to exercise Multiplication, and so conclude this Rule.

### Questions in MULTIPLICATION.

I. How many Feet and Tails have 30 Thrave of Dogs, when 24 Dogs make one Thrave?

*See the Work.*

$$\begin{array}{r}
 \text{Mul.} \quad 24 \\
 \text{By} \quad 30 \\
 \hline
 \end{array}$$

*Facit* 360 *Feet and Tails*

II. How many Sparrows at 10 a Penny will buy a Yoke of Oxen of 10 l.

First, bring 10 l. into Shillings, by 20, and then into Pence, by 12; and because 10 Sparrows are equal to one Penny, multiply that Product by 10, and your Work is finished; and the Answer will be 24000 Sparrows.

$$\begin{array}{r}
 10 \text{ l.} \\
 \times 20 \\
 \hline
 200 \text{ s.} \\
 \times 12 \\
 \hline
 2400 \text{ p.} \\
 \times 10 \\
 \hline
 24000 \text{ Sparrows.}
 \end{array}$$



#### 44 Questions in MULTIPLICATION.

III. If one Yard cost 2 Shillings and 3 Pence, what will 60 Yards cost?

*Ans.* 6*l.* 15*s.*

*See the Work.*

First, Multiply 2*s.* 3*d.* by 8, and that Product by 7; and because 8 times 7 makes but 56, which is less than 60 by 4, therefore multiply 2*s.* 3*d.* by 4; add this to the last Product by 7, and it gives the Answer.

*l. s. d.*  
*Mul.* 2 3  
*By* 8

18 0

7

6 06 0

09 0

} Add

*Facit* 6 15 0

This Method of finding the Value of any Number of Yards, Ells, Pounds, Hundreds, &c. at any Price *per* Yard, Ell, Pound, Hundred, &c. is of excellent Use for all Numbers under a Hundred, and so will be beneficial for such as buy or sell by Retail.

But in great Numbers we shall shew you another Method in the Rule of Practice following.

Yet sometimes it may so happen, that your Number, though a considerable great Number, may be wrought by this Method, as may more plainly be seen in the following Question.

IV. If a Pack of Yarn cost 8*l.* 16*s.* 5*d.* what will 336 Packs cost? *Ans.* 2963*l.* 16*s.*

*See the Work.*

First, I multiplied by 8, and that Product by 7, for 56, and that Product by 6, for 336, for 6 times 56 is 336.

*l. s. d.*  
 8 16 5  
 8

70 11 4

7

493 19 4

6

2963 16 0

And so of many other.

V.

## Questions in MULTIPLICATION, 45

V. If a Hoghead of Tobacco cost 3*l*. 7*s*. 9*d*. 1*q*. what will 729 Hogheads cost?

*Ans*w. 2470*l*. 4*s*. 11*d*. 1*q*. *See the Work.*

First, I multiply by 9, and that Product by 9 again, for 81; then because 9 times 81 is equal to 729, the Number given, I multiply that Product by 9 again, and it gives the Answer as in the Work.

|       |    |    |    |
|-------|----|----|----|
| 1.    | s. | d. | q. |
| 3     | 07 | 09 | 1  |
| <hr/> |    |    |    |
| 30    | 09 | 11 | 1  |
| <hr/> |    |    |    |
| 274   | 09 | 05 | 1  |
| <hr/> |    |    |    |
| 2470  | 04 | 11 | 1  |

VI. How many Changes may be rung on 6 Bells?

*Facit* 720.

This Question is wrought by that sort of Multiplication, which some call continued, which is nothing else but what Numbers you have given to be multiplied this Way; you must multiply the first by the second, and that Product by the third, and that Product again by the fourth; so continuing till you have multiplied all your given Numbers, one into another.

*See the Work.*

1. 2. 3. 4. 5. 6.

2. . . . .

3. . . . .

4. . . . .

5. . . . .

6. . . . .

7. . . . .

8. . . . .

9. . . . .

10. . . . .

11. . . . .

12. . . . .

13. . . . .

14. . . . .

15. . . . .

16. . . . .

17. . . . .

18. . . . .

19. . . . .

20. . . . .

21. . . . .

22. . . . .

23. . . . .

24. . . . .

25. . . . .

26. . . . .

27. . . . .

28. . . . .

29. . . . .

30. . . . .

Take another Question in continued Multiplication.

VII. What Number is that, which divided by 1, 2, 3, 4, 5, 6, 7, 8, 9, will leave no Remainder?

G

*Ans*w.

## 46 Questions in MULTIPLICATION.

*Ans.* 362880 found by Multiplication of 1, 2, 3, 4, 5, 6, 7, 8, 9; continually one into another, the last Product is the Answer.

VIII. In 1694 Years how many Months, Weeks, Days, Hours and Minutes?

When 12 Months of 28 Days a-piece make one Year, 4 Weeks make one Month, 7 Days one Week, 24 Hours one natural Day, and 60 Minutes one Hour. *Facit* 22022 Months, 88088 Weeks, 616616 Days, 14798784 Hours, and 887927040 Minutes.

*See the Work.*

The Answer is as in the Work. If you would find the Minutes in so many Years more exact, you must note that in a compleat Year are 365 Days, 5 Hours, and 49 Minutes, according to the Computation of the best Astronomers; and that is the Reason that every Fourth Year is called Leap Year, consisting of 366 Days; but the Work annexed may serve well enough for the Practice of the Rule.

1694 Years.

13

5082

1694

22022 Months.

4

88088 Weeks.

7

616616 Days.

24

2466464

1233232

14798784 Hours.

60

887927040 Min.

IX. In 205 Miles, the measured Distance between Manchester and London, how many Furlongs, Perches, Yards, Feet, Inches, and Barley Corns?

When 8 Furlongs make a Mile, 40 Perches make a Furlong, 5 Yards and  $\frac{1}{2}$  make one Perch or Rod, 3 Feet one Yard, 12 Inches one Foot, and 3 Barley Corns one Inch.

*See*



# Questions in MULTIPLICATION. 47

See the Works

205 Miles.

8

1640 Furlongs.

40

65600 Perches.

5½

328000

32800

360800 Yards.

3

1082400 Feet.

12

2164800

1082400

12988800 Inches.

3

38966400 Barley Corns.

X. If one Yard cost 12 Shillings, what will 142 Yards cost?

Ans. 85 l. 4 s.

Mul. 142

By 12

1704

l. s.

Facit 85 4

Here I multiply by 12, the contracted Way, and from the Product cutting off the last Figure, half the rest will be Pounds, and the Remainder Shillings.

XI. At 6 s. 6 d. a Yard, what will 142 Yards cost ?

*Ans.* 46 l. 3 s.

$$\begin{array}{r}
 142 \\
 \underline{6\frac{1}{2}} \\
 852 \\
 \underline{71} \\
 9213 \\
 \underline{1. \text{ms.}} \\
 46 \text{ } 3
 \end{array}$$

Here I multiplied first by 6, for 6 Shillings, and for 6 Pence, took  $\frac{1}{2}$  of 142, which I add to the last Product, and from the Sum cutting off the last Figure, half of that Sum is Pounds, and the Figure cut off Shillings.

## D I V I S I O N.

**BY DIVISION** we discover how often one Number is contained in another.

In *Division* are three principal Parts to be taken Notice of.

*First*, The *Dividend*, or Number to be divided.

*Secondly*, The *Divisor*, or Number by which we divide.

*Thirdly*, The *Quotient*, or Number proceeding from the other two.

Sometimes by accident there is a fourth Number, called a *Remainder*.

In *Division* it holds,

As the *Divisor* : To an Unit ::

So the *Dividend* : To the *Quotient*.

So if 4 Yards cost 32 Shillings; What will one Yard cost ?

Here 4 Yards the *Divisor* bears such Proportion to an Unit, or one Yard, as 32 Yards, the *Dividend*, doth bear to the *Quotient*; which will be the Answer to the Question.

To

## Division in INTEGERS.

49

To work this Question, place your Numbers as underneath.

*Yd. Sh. Yd. Sh.*

If 4 : 32 :: 1 : Facit 8

4) 32 (8 Shill.

32

0

Because 1 doth not multiply, I divide 32 by 4, saying, how oft 4 in 32? Answer 8 times; which I place in my Quotient as you see.

*Division is either Single or Compound.*

Single Division is when the Divisor is but one Figures and the Dividend but two at the most, as in the Question before going. And this sort of Division may either be performed by the Memory, or at most by the Table of Multiplication, by seeking your Divisor on the Top of the Table, running down the same till you find the Dividend, and over against it, in the first Column is your Quotient sought.

Compound Division is when the Dividend consisteth of many Places, and the Divisor of one or more Places.

When a Question of Compound Division is propounded to be wrought, you must proceed according to the Work of the following Rule.

First write down your Dividend, making a crooked Line at either end thereof, that on the Left-hand to contain the Divisor, and that on the Right-hand for the Quotient; and having placed your Divisor in its place, distinguish with a Point, so many Places of your Dividend towards your Left-hand, as are equal, or next exceeding your Divisor; and asking how oft your Divisor is contained in the said Sum, the Answer must be placed in your Quotient on the Right-hand the Dividend; then multiply your Divisor by the Figure last placed in your Quotient, setting your Product under your aforesaid distinguished Sum; and drawing a Line under both, take the lower from the higher, and to the Remainder, point and bring down your next Figure of the Divi-



Dividend, with which proceed as you did with your distinguished Number, and so on till you have pointed and brought down all the Figures of your Dividend. And *Note*, That as many Points as you have made in your Dividend, so many Figures will be in the Quotient; all which will be made more plain in the Work of the following Examples.

## EXAMPLE I.

By one Figure.

Divide 12096

By 7

See the Work.

Having placed the Numbers as you see in the Work, make a Point under the 2d Figure of your Dividend, and ask how oft 7 in 12? *Ans.* once; then placing 1 in your Quotient, say once 7 is 7, which placed under 12, and subtracted from it, rest 5, to which point, and bring down the next Figure 0; then how oft 7 in 50? *Ans.* 7 times; place 7 in your Quotient, saying 7 times 7 is 49, which subtracted from 50, rest 1, to which point, and bring down the next Figure, 9; then how oft 7 in 19? *Ans.* 2 times; set 2 in your Quotient, saying 2 times 7 is 14, which subtract from 19, rest 5; to which point, and bring down the last Figure of your Dividend 6, asking how oft 7 in 56? *Ans.* 8 times; place 8 in your Quotient, saying 8 times 7 is 56, which subtract from 56, rest 0, and your Work is finished, and your Quotient is 1728, as in the Work.

This Question is the same, as if one should ask, in 12096 Days how many Weeks?

E X

# Division in INTEGERS.

51

## EXAMPLE II.

By two Figures.

Let it be required to Divide 123156

By 36

See the following Work.

Having placed your Numbers as in the Work, make a Point under 3, the third Figure of your Dividend, because you cannot have 36 in 12, the two first Figures thereof.

Then ask how oft 36 in 123? or which is better, how oft 3 in 12? Suppose 4 times; but I cannot have 4 times 6 in 3, for you must take the first Figure of your Divisor no oftner in the first Figure, or first and second Figure of your Dividend, than you can have the 2d Figure of your Divisor in the Remainder of the first, or first and second joined to the second or third. Suppose therefore 3 times; but can I have 3 times 6 in 23? that I can; wherefore place 3 in your Quotient, and multiplying my Divisor thereby, the Product (*viz.*) 108 I place under 123, and to the Remainder, 15, point and bring down the next Figure 1, of your Dividend; then how oft 36 in 151, or how oft 3 in 15? *Ans.* 4 times; place 4 in your Quotient, and multiplying the Divisor thereby, your Product, to wit, 144 subtracted from 151, leave 7

to which point and bring down the next Figure 5; then how oft 36 in 75, or 3 in 7? *Answ.* 2 times; place 2 in your Quotient, multiplying your Divisor thereby, your Product (*viz.*) 72, brought from 75, to the Remainder 3, point and bring down your next and last Figure of your Dividend, to wit, 6, asking how oft 36 in 36, or 3 in 3? *Ans.* 1 time; place 1 in your Quotient, saying 1 time 36 is 36, which subtracted from 36, rest 0, and your Work is finished; and the Quotient is found to be 3421.

See the Work.

$$\begin{array}{r}
 36 \overline{) 123156} \quad (3421, \\
 \underline{108} \phantom{00} \\
 151 \phantom{00} \\
 \underline{144} \phantom{00} \\
 75 \phantom{00} \\
 \underline{72} \phantom{00} \\
 36 \phantom{00} \\
 \underline{36} \phantom{00} \\
 0
 \end{array}$$

This

*Division in INTEGERS.*

This Question is the same, as if one should ask in 123156 Inches, how many Yards?

*EXAMPLE III.*

*By three Figures.*

Let it be required to Divide 379302

By 231

*See the Work.*

231) 379302 (1642

The Manner of Working being the same as in the last, we shall forbear the Explication thereof; for the Operation by two Figures, being well understood, the Work in any other will be easy. In this Question, the Quotient you see will be 1642, and is the same as if it were asked, in 379302 solid Inches, how many Wine Gallons?

231

1483

1386

970

924

462

462

0

*EXAMPLE IV.*

Divide 746321

By 6142

*See the Work.*

6142) 746321 (121 $\frac{3139}{6142}$

In this Example, after your Division is finished, you see there is a Remainder of 3139 which is the Numerator of a Fraction, and the Divisor is a Denominator thereunto, and the intire Quotient is 121 $\frac{3139}{6142}$  as is the Work.

6142

13212

12284

9281

6142

3139

The Value of this Fraction, or any other in the Parts of the Integer, may be found as in the Work of the following Example.

*E X-*



EXAMPLE V.

Let it be required to divide a Prize worth 368424 Pounds, among 1728 Men; and let each Man's Part in Pounds, Shillings and Pence, be demanded.

*See the Work.*  $l. s. d$

After the Division is finished, there is a Remainder of 360 Pounds; which multiplied by 20, brings them into Shillings, to wit, 7200, which divided by the former Divisor, quotes 4 Shillings, and leaves a Remainder of 288 Shillings, which multiplied by 12, brings them into 3456 Pence; and divided by the former Divisor, quotes 2 Pence, and Nought remains; but if any thing had remained, it must have been multiplied by 4, for Farthings; and the like of any other. So the Quotient, or each Man's Part, will be 213 *l.* 4 *s.* 2 *d.*

$$\begin{array}{r}
 1728 \overline{) 368424} \quad (213 \cdot 4 \cdot 2 \\
 \underline{\phantom{00}3456} \phantom{00} \\
 \phantom{00}2282 \phantom{00} \\
 \phantom{00}\underline{\phantom{00}1728} \phantom{00} \\
 \phantom{0000}5544 \phantom{00} \\
 \phantom{0000}\underline{\phantom{00}5184} \phantom{00} \\
 \phantom{000000}360 \text{ Remaind.} \\
 \phantom{000000}\text{Shill. in a Pound } 20 \\
 \phantom{000000}\underline{\phantom{000000}} \\
 \phantom{000000}7200 \text{ (4 Shill.)} \\
 \phantom{000000}\underline{\phantom{000000}6912} \\
 \phantom{00000000}288 \text{ Rem.} \\
 \phantom{00000000}\text{Pence in a Shill. } 12 \\
 \phantom{00000000}\underline{\phantom{00000000}} \\
 \phantom{00000000}576 \\
 \phantom{00000000}\underline{\phantom{00000000}288} \\
 \phantom{0000000000}3456 \text{ (2 Pence.)} \\
 \phantom{0000000000}\underline{\phantom{0000000000}3456} \\
 \phantom{000000000000}0
 \end{array}$$

Division may be performed without charge to the Memory, by making a Tablet of your Divisor multiplied into the 9 Digits, and may prove of good Use to the Learner; not only in great Numbers, but by practising a few, this Way he will attain to a good Knowledge of Division, and be enabled to work easily without such a Table.

## EXAMPLE I.

Let the Dividend be 67254, and the Divisor 19. Make a Table by Duplication, or Addition, or by Multiplication.

Over-against 1 place your Divisor; for 2 double your Divisor, or first Number; for 3, add the 1st and 2d Number; the 4th is the 2d doubled; the 5th is the Sum of the 2d and 3d; the 6th is the double of the 3d; the 7th is the Sum of the 3d and 4th; the 8th is the 4th doubled; the 9th is the Sum of the 4th and 5th, otherwise the Divisor multiplied by any of the 9 Digits, gives the Number in the Table over-against such Digit. And after this way may a Table be made for any Divisor whatever.

|   |     |
|---|-----|
| 1 | 19  |
| 2 | 38  |
| 3 | 57  |
| 4 | 76  |
| 5 | 95  |
| 6 | 114 |
| 7 | 133 |
| 8 | 152 |
| 9 | 171 |

To work the former Question, place your Numbers as usual; then seek how far your Divisor will reach into your Dividend; which will be to two Places, which is 67; how oft 19 in 67? and by the Table seeking for that Number, or next less to it, I find it 3 times (*viz.*) 57, which I set under 67, and subtract, and it leaves 10, to which point, and bring down the next Figure 2; then how oft 19 in 102? and by the Table I find 5 times, (*viz.*) 95, which subtracted from 102, leaves 7, to which point, and bring down 5, the next Figure of your Dividend, asking how oft 19 in 75? and by the Table I find 3 times, to wit, 57, which subtract from 75, leaves 18, to which point, and bring down the next and last Figure of your Dividend 4, asking how oft 19 in 184, and by the Table I find 9 times, to wit, 171, which subtracted from 184, leaves 13 for a Remainder, and your Work is finished, and the Quotient will be 3539 $\frac{13}{19}$ .

*See the Work.*

19) 67254 (3539 $\frac{13}{19}$

57

102

95

75

57

184

171

13 Rem.

## Division of diverse DENOMINATIONS. 55

### EXAMPLE II.

Let it be required to Divide 14672865 by 6425.

*See the Work.*

6425) 14672865 (2283

|   |       |
|---|-------|
| 1 | 6425  |
| 2 | 12850 |
| 3 | 19275 |
| 4 | 25700 |
| 5 | 32125 |
| 6 | 38550 |
| 7 | 44975 |
| 8 | 51400 |
| 9 | 57825 |

12850

18228

12850

53786

51400

23865

19275

4590

The making of the Table, and the working of the Example, is the same as before; so we shall not trouble ourselves to explain it, but leave it to the Consideration of the Learner.

## Division of diverse DENOMINATIONS.

As in *Multiplication*, so here likewise in *Division*, we shall say something of Division of Numbers of diverse Denominations.

And first when the Dividend is a Number of diverse Denominations, and the Divisor an Integer; and for Example take the following Question.

I. If a Man in 12 Months spend 64*l.* 18*s.* 9*d.* 3*q.* what will his Expences be for one Month?



## 56 Division of diverse DENOMINATIONS.

Place your Numbers as in the Work you see done, and ask how oft 12 in 64? *Ans.* 5 times, place 5 in the Quotient for Pounds; then 5 times 12 is 60, from 64, rest 4, to which point, and bring down 18 Shillings, and ask how oft 12 in 4l. 18s. or 98 Shillings? *Facit*, 8 times, which place in your Quotient for Shillings; then 8 times 12 is 96, or 4l. 16s. which subtract from 4l. 18s. rest 2 Shillings, to which point and bring down 9d. then how oft 12 in 2s. 9d. or 33 Pence? *Facit*, 2 times, place 2 in your Quotient for 2 Pence, saying 2 times 12 is 24 Pence, or 2 Shillings; from 2 Shill. and 9 Pence, rest 9 Pence, to which point, and bring down 3 Farthings; then how oft 12 in 9d. 3q. or 39q. *Facit*, 3 times, place 3q. in your Quotient, saying 3 times 12 is 36, or 9d. from 9d. 3q. rest 3 Farthings, which is  $\frac{3}{4}$  or  $\frac{1}{4}$  of a Farthing.

See the Work.

l. s. d. q. l. s. d. q.  
12) 64 . 18 . 9 . 3 (5 . 8 . 2 . 3

60

4 18

4 16

2 9

2 0

9 3

9 0

$\frac{3}{4}$  or  $\frac{1}{4}$  of a q.

So the true Quotient, or the monthly Expence, is 5l. 8s. 2d. 3q.  $\frac{1}{4}$ .

Take another Example.

II. Divide 4l. 15s. 6d. among 6 Men.

See the Work.

l. s. d.  
6) 4 15 6  
4 10

5 6

5 6

0

And so of any other.

An

## Division of diverse DENOMINATIONS. 57

An Example or two where both the Dividend and Divisor are Numbers of diverse Denominations.

I. Divide 31 *l.* 17 *s.* 6 *d.* 3 *q.* by 12 *l.* 12 *s.* 6 *d.*

Your Numbers being placed as in the Work, ask how oft 12 Pound 12 *s.* 6 *d.* in 31 *l.* 17 *s.* 6 *d.* or how oft 12 in 31?

*Ans.* 2 times; place 2 *l.* in your Quotient, and by it multiply your Divisor by the

*See the Work.*

|           |           |           |           |           |           |           |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| <i>l.</i> | <i>s.</i> | <i>d.</i> | <i>q.</i> | <i>l.</i> | <i>s.</i> | <i>d.</i> |
| 31        | 17        | 6         | 3         | 12        | 12        | 6         |

25 . 05 . 0

6 12 6 3

6 6 3 0

6 3 3

6 3 3

0

Rules in Multiplication, and the Product 25 *l.* 05 *s.* 0 *d.* subtract from 31 *l.* 17 *s.* 6 *d.* rest 6 *l.* 12 *s.* 6 *d.* to which point and bring down 3 *q.* saying, how oft 12 in 6 *l.* 12 *s.* or 132 Shillings? *Ans.* 10 times; place 10 Shillings in your Quotient, and by it multiply your Divisor by the Rules laid down in Multiplication of diverse Denominations, and the Product will be 6 *l.* 6 *s.* 3 *d.* which subtract from 6 *l.* 12 *s.* 6 *d.* 3 *q.* leaves 6 *s.* 3 *d.* 3 *q.* Lastly, how oft 12 in 6 *s.* 3 *d.* or 75 Pence? *Ans.* 6 times; place 6 *d.* in your Quotient, and by it multiply your Divisor, which by the Rules before mentioned will be 6 *s.* 3 *d.* 3 *q.* which subtract from 6 *s.* 3 *d.* 3 *q.* resteth 0, and the Quotient I find to be 2 *l.* 10 *s.* 6 *d.*

*Take another Example.*

II. Divide 11 *l.* 6 *s.* 8 *d.* by 3 *l.* 5 *s.*

*See*

# 58 Contractions in DIVISION.

An Example of two where both the Dividend and Divisor are Numbers of Contractions. See the Work.

$$\begin{array}{r} \text{l. s. d. q.} \\ 1. \text{ Divide } 3815 \text{ by } 5 \\ 3815 \end{array}$$

$$\begin{array}{r} 915 \\ 5 \overline{) 3815} \\ \underline{45} \phantom{00} \\ 31 \phantom{00} \\ \underline{30} \phantom{00} \\ 10 \phantom{00} \\ \underline{10} \phantom{00} \\ 0 \end{array}$$

## Contractions in DIVISION.

For the Learner's Advantage, we will here annex 2 or 3 Contractions in Division.

I. And first to divide by any of the 9 Digits, without setting down any Figures but the Quotient itself.

To divide by 2, is but to halve the Number, setting down the Figures of the Quotient orderly under the Dividend; so in the Example,  $\frac{1}{2}$  of 7 is 3, set down 3, carry the 1 that remains; then  $\frac{1}{2}$  of 16 is 8, set down 8, and  $\frac{1}{2}$  of 4 is 2, and  $\frac{1}{2}$  of 2 is 1; so the Quotient is 3821.

Example.

Divide 7642, by 2

Quot. is  $\frac{1}{2}$  3821

To divide by 3 is to take  $\frac{1}{3}$  of the Number given; so  $\frac{1}{3}$  of 7 is 2, of 14 is 4, of 22 is 7, of 16 is 5, and 1 remains, which is  $\frac{1}{3}$ , and the Quotient is 2475 $\frac{1}{3}$ .

Divide 7426, by 3

$\frac{1}{3}$  is 2475 $\frac{1}{3}$

So to divide by 5, is to take  $\frac{1}{5}$  of the Number given; so here  $\frac{1}{5}$  of 6 is 1, of 17 is 3, of 24 is 4, of 45 is 9, and the Quotient is 1349, and so of any other.

Divide 6745, by 5

$\frac{1}{5}$  is 1349 Quot.

After





6 is 3, of 84 is 42. Lastly  $\frac{1}{3}$  of 3 is 1, of 42 is 14, the Quotient sought, because my Divisor is become an Unit.

*See the Work.*

The higher Num. are all Divisors.  $\begin{array}{r} 48 \overline{) 24612631} \\ 672 \overline{) 336168844214} \end{array}$

The lower Numbers are Dividen.

### Proof of Division.

Multiplication and Division mutually prove each other: For in Multiplication, if you divide your Product by your Multiplier, the Quotient will be your Multiplier: Likewise in Division, if you multiply your Quotient by your Divisor, the Product will be your Dividend.

### Examples in both.

Multiply 41725

By 632

83450

125175

250350

632) 26370200 ( 41725 Proof of the Multiplication.

2528

83450

1090

125175

632

250350

4582

26370200 Proof of the Division.

4424

1580

And so of any other.

1264

3160

3160

0

QUES.

QUEST. I.

I. Divide 46462 Yards among 246 Men.

See the Work.

$$\begin{array}{r}
 246 \overline{) 46462} \\
 \underline{492} \phantom{00} \\
 2186 \phantom{00} \\
 \underline{2182} \phantom{00} \\
 4 \phantom{00} \\
 \underline{4} \phantom{00} \\
 0
 \end{array}$$

856 (3 Quarters.

738

118

4

472 (1 Nail.

246

226 Remain.

Every Man must have 188 Yards, 3 Quarters and one Nail, together with  $\frac{226}{246}$  Parts of a Nail.

QUEST. II.

II. If a C. of Tobacco, or 112 l. cost 2 l. 11 s. 4 d. what will one Pound Weight cost?

Ans. 5 d.  $\frac{1}{2}$ .

See the following Work.

I

First,



First, I brought  $2\text{ l. } 11\text{ s. } 4\text{ d.}$   
 into Pence, and divided by 112,  
 gives 5d. in the Quotient, the  
 Remainder multiplied by 4, for  
 Farthings, and divided by 112  
 gives 2 Farthings.

| l.                                                                                                                                                                            | s. | d. |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|
| 2                                                                                                                                                                             | 11 | 4  |
| <div style="display: flex; justify-content: flex-end;"> <div style="text-align: right; padding-right: 10px;">51</div> <div style="text-align: right;">12</div> </div>         |    |    |
| <div style="display: flex; justify-content: flex-end;"> <div style="text-align: right; padding-right: 10px;">616</div> <div style="text-align: right;">(5 Pence.</div> </div> |    |    |
| <div style="display: flex; justify-content: flex-end;"> <div style="text-align: right; padding-right: 10px;">560</div> </div>                                                 |    |    |
| <div style="display: flex; justify-content: flex-end;"> <div style="text-align: right; padding-right: 10px;">56</div> </div>                                                  |    |    |
| <div style="display: flex; justify-content: flex-end;"> <div style="text-align: right; padding-right: 10px;">4</div> </div>                                                   |    |    |
| <div style="display: flex; justify-content: flex-end;"> <div style="text-align: right; padding-right: 10px;">224</div> <div style="text-align: right;">(2 Farth.</div> </div> |    |    |
| <div style="display: flex; justify-content: flex-end;"> <div style="text-align: right; padding-right: 10px;">224</div> </div>                                                 |    |    |
| <div style="display: flex; justify-content: flex-end;"> <div style="text-align: right; padding-right: 10px;">0</div> </div>                                                   |    |    |

## QUEST. III.

III. A square Acre contains 160 Perches: Now the  
 Side of a Field is 12 Perches, how much on the other  
 Side will go to make an Acre?

Ans. 13 Perches and  $\frac{1}{3}$ .

| See the Work.                                                                                                                                                                                  | 160 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <div style="display: flex; justify-content: flex-end;"> <div style="text-align: right; padding-right: 10px;">12</div> <div style="text-align: right;">13 <math>\frac{1}{3}</math></div> </div> |     |

## QUEST. IV.

IV. A Captain and 160 Soldiers gain a Prize worth  
 362 Pounds, of which the Captain had  $\frac{1}{3}$  for his Share,  
 the rest was divided equally among the Soldiers; what  
 was each Man's Part.

Ans. { The Captain's Share } 72 l. 8 s.  
 { Each Soldier's Share } 1 l. 16 s.  $\frac{1}{3}$ .

See the following Work.

*Reduction by Multiplication*  
The Prize 362

*Reduction by Division*  
The Captain's Share. 8

*Reduction by Division*  
Reduce 362 by 8 into Farthings. 452 1/2

20

*First, I multiplied by 20 and so*

*I multiplied 452 1/2 by 12 in Shillings and Pence*

*and brought out 5430 Shillings*

*those Shillings, to wit, 5430 I multiplied by 12, bringing in the Pence, 8733 Pence, which multiplied by 4, and adding 1 to the Product, brings them all into Farthings, and your Work is finished.*

*5430 Shillings*

*8733 Pence*

*34932 Farthings*

32

And thus much shall suffice for Division.

8733 Pence

## REDUCTION.

**BY REDUCTION** we change Money, Weight, Measure, &c. out of one Denomination into another, whereby we know how many of one Denomination are equal to so many of the other.

We shall (tho' contrary to other Authors) divide Reduction into three Parts.

First, *Reduction by Multiplication.*

Secondly, *Reduction by Division.*

Thirdly, *Reduction by Multiplication and Division.*

Of these in their Order.

*Reduction by Multiplication*, is when we bring a greater Denomination into a less, as Pounds into Shillings, Pence into Farthings, Yards into Quarters or Nails, &c.

See the *Work of the following Questions.*

# Reduction by MULTIPLICATION.

## QUEST. I.

Reduce 36 l. 7 s. 9 d. 1 q. into Farthings.

|                                             |                |
|---------------------------------------------|----------------|
| First, I multiplied by 20, and as           | l. s. d. q.    |
| I multiplied took in the 7 Shillings,       | 36 . 7 . 9 . 1 |
| and brought the Pounds into Shillings,      | 20             |
| those Shillings, to wit, 727, I mul-        | —              |
| tiplied by 12, bringing in the 9 d.         | 727 Shillings. |
| <i>Facit</i> , 8733 Pence, which multiplied | 12             |
| by 4, and adding 1 to the Product,          | —              |
| brings them all into Farthings, and         | 1463           |
| your Work is finished.                      | 727            |
|                                             | —              |
|                                             | 8733 Pence.    |

34933 Farthings.

## QUEST. II.

In 672 Yards, how many Quarters and Nails?

See the Work.

672 Yards

4

2688 Quarters.

4

10752 Nails.

## QUEST. III.

Reduce 21 C. 2 q. 11 l. into Ounces.

*Answ.* 38704 Ounces.

See



# Reduction by MULTIPPLICATION. 650

See the Work.

$$\begin{array}{r}
 \text{C.} \quad \text{q.} \quad \text{lb.} \\
 21 \quad 2 \quad 14 \\
 \hline
 4 \\
 \hline
 86 \text{ Quarters.} \\
 28 \\
 \hline
 689 \\
 173 \\
 \hline
 2418 \text{ Pounds.} \\
 16 \\
 \hline
 14514 \\
 2419 \\
 \hline
 2419
 \end{array}$$

38704 Ounces

## QUEST. IV.

Reduce 72467 Nobles into Greats.

Ans. 1449340 Groats.

See the Work.

$$\begin{array}{r}
 72467 \text{ Nobles.} \\
 20 \\
 \hline
 1449340 \text{ Groats.}
 \end{array}$$

## QUEST. V.

In 6 Bags of Pepper, weighing each 3 C. 2 q. 11 Pound, how many Pound?

Ans. 2418.

See

# 66 Reduction by Division.

See the following Work.

|       |           |     | Or thus. |         |     |
|-------|-----------|-----|----------|---------|-----|
| C.    | q.        | lb. | S.       | q.      | lb. |
| 3     | 2         | 11  | 13       | 2       | 11  |
|       |           | 6   |          |         | 4   |
| <hr/> |           |     | <hr/>    |         |     |
| 21    | 2         | 10  | 88       |         |     |
| 4     |           |     | 88       |         |     |
| <hr/> |           |     | <hr/>    |         |     |
| 86    | Quarters. |     | 1130     |         |     |
| 28    |           |     | 2971     |         |     |
| <hr/> |           |     | <hr/>    |         |     |
| 688   |           |     | 403      |         |     |
| 173   |           |     | 06       |         |     |
| <hr/> |           |     | <hr/>    |         |     |
| 2418  | Pounds.   |     | 2418     | Pounds. |     |

## QUEST. VI.

In 142 Hogheads how many Gallons and Pints?

See the Work.

|    |                             |               |
|----|-----------------------------|---------------|
|    |                             | 142 Hogheads. |
|    |                             | 63            |
| 63 | Gallons make a Hoghead, and | 426           |
| 8  | Pints a Gallon              | 852           |
|    |                             | <hr/>         |
|    |                             | 8946 Gallons. |
|    |                             | 8             |
|    |                             | <hr/>         |
|    |                             | 71568 Pints.  |

## Reduction by Division.

Reduction by Division, is when we bring a less Denomination into a greater, as Farthings into Pence, Shillings into Pounds, and Nails into Quarters or Yards, &c.

In this Part of the Rule we will use the Converse of those Questions we had in the former Part of the Rule, which will be a Proof of the Work.

3 QUEST.

QUEST. I.

In 34933 Farthings how many Pounds?

Instead of dividing the Farthings by 4, I took  $\frac{1}{4}$  Part, and so  $\frac{1}{2}$  of that, to bring them into Shillings, and from the Shillings I cut off the last Figure, and took half the rest, instead of dividing by 20; and the Answer is 36 l. 7 s. 9 d. 1 q.

QUEST. II.

In 10752 Nails how many Yards and Quarters?

See the Work.

10752 Nails.  
 4 2688 Quarters.  
 672 Yards.

QUEST. III.

In 38704 Ounces how many Hundreds, Quarters and Pounds?

See the Work.

16) 38704 (2419 Pounds.

32 28) 2419 (86

67 224 186

64 179 21 C. 2 q.

30 168

16 11 lb.

144

144

8

Ans. 21 C. 2 q. 11 lb.

0

QUEST.



QUEST. V.

Reduce 1449340 Grains into Nobles.

Facit 72467 Nobles.  
 1449340 Grains  
 72467 Nobles  
 1449340 Grains  
 72467 Nobles

QUEST. VI.

Six equal Bags of Pepper weigh 2418 Pounds, the Weight of one Bag is demanded, in Hundreds, Quarters and Pounds.

2418  
 403  
 112  
 3 C. 2 q. 11 lb.

QUEST. VII.

In 71568 Pints how many Hogheads?

Ans. 1. 2.

71568 Pints,  
 8946 Gallons,  
 63  
 264  
 252  
 126  
 126  
 0

Reduction

The Method how these Divisors and Multipliers are found is in the following Questions, which I shall now put to you.

**Reduction by MULTIPLICATION and Division.**  
Under this Head may be comprised the Method of exchanging Coins, Weights and Measures that have not that immediate Reference to one another, as those spoken of before; and is of excellent Use to most Persons, as well Merchants as meaner Chapmen.

We shall make all plain in the Work of the following Examples.

**QUEST. I.**

In 672 Nine-pences how many Thirteen-pence Half-pennies?

In this or the like Question, I consider how many of one Coin are equal to any Number of the other; and I find that 3 Nine-pences are equal to 2 Thirteen-pence Half-pennies. And which, to make my Multiplier, I consider whether the Answer, or the Number sought, will be greater or less than the Number given; and accordingly I make the greater, or less, my Multiplier.

So here I consider, that in 672 Nine-pences there are less Thirteen-pence Half-pennies; so the less Number, to wit 2, is my Multiplier, and 3 my Divisor.

|         |                  |      |                 |
|---------|------------------|------|-----------------|
| 672     | <i>Answer.</i>   | 448  | Thirteen-pence  |
| 2       |                  |      | [Half-pennies.] |
| 3) 1344 |                  |      |                 |
| 12      | Or thus,         | 672  |                 |
| 14      | Its Double       | 1344 |                 |
| 12      | $\frac{1}{3}$ is | 448  | the Answer.     |
| 24      |                  |      |                 |
| 24      |                  |      |                 |
| 0       |                  |      |                 |

to the Answer.

QUEST.

K.

The

## 70 Reduction by Multiplication and Division.

The Method how these Divisors and Multipliers are found in this and the following Questions, is thus; bring both your Coins, Weights, Measures, &c. into their least equal known Parts, which may be brought into lesser, by dividing them both by some known Divisor; or by taking  $\frac{1}{2}$  or  $\frac{1}{3}$ , &c. as oft as you can.

So in 9d. are 36 Farthings.

And in  $13\frac{1}{2}$  are 54 Farthings.

Say  $\frac{1}{2}$  of 36 is 18, of 54 is 27  $\frac{1}{3}$   
 of 18 is 6, of 27 is 9;  $\frac{1}{3}$  of 6 is 2, of 9 is 3; so are 2 and 3 the Numbers sought.

$$\begin{array}{r|l} 36 & 18 & 6 & 2 \\ \hline 54 & 27 & 9 & 3 \end{array}$$

The other Numbers are Multipliers and Divisors, as well as these two, but these being the least, are most fit for Use.

### QUEST. II.

In 100 Thirteen-pence Half-pennies how many Nine-pences?

This is but the Converse of the last, and by the Work you may see the Answer is 150.

100

3

300

$\frac{1}{2}$  150 Nine-pences.

### QUEST. III.

In 672 English Ells how many Yards English? Ans. 840.

672

5

$\frac{1}{4}$  3360

840 the Answer.

I

QUEST.



# Reduction by Multiplication and Division. 71

## QUEST. IV.

In 672 Ells *English*, how many Ells *Flemish*, when 1 Yard  $\frac{1}{4}$  is an Ell *English*, and  $\frac{1}{2}$  of a Yard an Ell *Flemish*?

*Answ.* 1120, or as 3 to 5.

## QUEST. V.

In 642 Nobles how many Crowns? *Answ.* 856, or as 4 to 3.

$$\begin{array}{r}
 642 \\
 \underline{4} \\
 3) 2568 \quad (856 \\
 \underline{24} \\
 16 \\
 \underline{15} \\
 18 \\
 \underline{18} \\
 0
 \end{array}$$

## QUEST. VI.

In 856 Crowns how many Nobles? *Answ.* 642. The-  
Converse of the last.

## QUEST. VII.

In 672 little Hundred, how many great Hundred?  
*Answ.* 600.

A little Hundred is 100; a great Hundred is 112.

$$\begin{array}{r}
 112) 67200 \quad (600 \\
 \underline{672} \\
 0
 \end{array}$$

K 2

QUEST.

## 72 Reduction by Multiplication and Division

### Q U E S T. VIII.

In 600 great Hundred, how many little Hundred?

*Answ.* 672, the Converse of the last.

### Q U E S T. IX.

In 672 Guineas, at 1  $\text{l.}$  1  $\text{s.}$  8  $\text{d.}$  per Piece, how many Pounds Sterling?

*Answ.* 728

*See the Work.*

|               |                       |
|---------------|-----------------------|
| 672           | Or thus, 672          |
| 13            | Add $\frac{1}{12}$ 56 |
| 2016          | The Sum 728           |
| 672           |                       |
| 12) 8736 (728 |                       |
| 84            |                       |
| 33            | Fence in a Pound      |
| 24            | Fence in a Guinea     |
| 96            |                       |
| 96            |                       |

In this second Operation, because 1  $\text{s.}$  8  $\text{d.}$  is the  $\frac{1}{12}$  of a Pound, I take  $\frac{1}{12}$  of 672, which added to 672, gives the Answer 728, as before.

### Q U E S T. X.

In 728 Pounds how many Guineas at 1  $\text{l.}$  1  $\text{s.}$  8  $\text{d.}$  each?

*Answ.* 672.

The Converse of the last.

### Q U E S T. XI.

A Merchant at *Amsterdam* is indebted to a Merchant at *London* in 642 Pounds, and would pay it in *Spanish Guilders*

## The Golden Rule; or, Rule of THREE. 73

Guilders at 2 Shillings per Piece; How many must the English Merchant receive? *Ans.* 6420.

Two Shillings being the tenth Part of a Pound, I only add a Cypher to the Pounds, and it gives the Answer, to wit, 6420.

### Q U E S T. XII.

In 672 Spanish Guilders how many French Pistoles, at 17 Shillings 6 Pence per Piece? *Ans.* 762, or 56 Pistoles and 14 Shillings Sterling.

*See the Work.*

$$\begin{array}{r}
 672 \quad 18 \quad 4 \\
 \times 17 \quad 6 \\
 \hline
 4272 \\
 11520 \\
 \hline
 117920
 \end{array}$$

245

$$\begin{array}{r}
 238 \\
 210 \\
 \hline
 8
 \end{array}$$

## The Golden Rule; or Rule of THREE.

IT is called *The Golden Rule*, for the Excellency thereof: Sometimes it is called *The Rule of Three*, or *Rule of Proportion*, because there are always three Numbers given to find a fourth, which must bear such Proportion to the third as the second bears to the first.

The chiefest Difficulty lies in stating your Question; which that you may do, observe the following Rule.

*The Question First and Third are of the same,  
 The Middle Number has another Name,  
 And which to make the Third you cannot miss,  
 The unknown Quantity it always is.*

E X.



# 74 The Golden Rule, or, Rule of THREE.

## EXAMPLE.

If 16 Yards cost 5 Pounds, what will 144 Yards cost?

Thus stated, if  $16 : 5 :: 144 :$

Here you see the first and the third Number is Yards, the middle Number is Pounds; and because I wanted the Price of 144 Yards, I put it in the last or third Place.

This being understood, we will give you such another Rule, for the working of any such Question, which is this that follows.

If the Fourth the Second must exceed, then see  
By the Great Extream it multiplied be;  
But if it must be less than Second, aim  
To multiply it by the less Extream.

## EXAMPLE.

If 13 Packs cost 326 Pounds, what will 39 Packs cost?  
Answ. 978 l.

P. l. P.  
If  $13 : 326 :: 39$

39

2934  
978

13) 12714 (978 l. the Answer.

117

101

91

104

104

0

Having

## The Golden Rule, or, Rule of THREE. 75

Having stated your Question, as before, it may be easily seen, that the 4th Number will exceed the 2d; for 30 Packs must needs cost more than 13 Packs; wherefore I multiply the 2d, or middle Number, by the greater of the two Extreams, viz. 39; then must the less Extream, to wit, 13, be my Divisor.

So multiplying 326 by 39, the Product 12714, I divide by 13, and the Quotient is 978 Pounds, the Answer.

### QUEST. II.

If 64 Yards of Broad Cloth cost 38 Pounds 8 Shillings, what will 5 Yards of the same Cloth cost? *Ans. 3l.*

Because your Numbers ought to be of one Denomination, before any Work can be done, you must reduce 38 Pounds 8 Shillings into Shillings; then state and work your Question as underneath.

| Yd.     | s.    | Yd.              | l.  | s.     |
|---------|-------|------------------|-----|--------|
| If 64 : | 768 : | 5 :              | 38  | 8      |
|         |       |                  | 20  |        |
| 64)     | 3840  | (60 Shill.       | 768 | Shill. |
|         |       | or 3 l. the Ans. |     |        |
|         | 384   |                  |     |        |
|         | 00    |                  |     |        |

Here I multiplied the middle Number by the less Extream, because the fourth must be less than the second; the Reason is evident.

*Note likewise,* That your fourth Number must be of the same Denomination with your second; so here your second Number being Shillings, your fourth Number, or the Answer to the Question is Shillings; likewise, to wit, 60 Shillings, which divided by 20, gives 3 Pounds, the Answer to the Question.

### QUEST. III.

If 6 Yards of Holland cost 3 Pounds 12 Shillings and 6 Pence, what will 64  $\frac{1}{4}$  cost?

Before

## 26. The Golden Rule, or, Rule of THREE

Before you state your Question, bring the first and third Number into Quarters, and your second into Pence, as underneath.

1a. 6 4 3 12 6 64  
4 20 257 Quart.

24 Quart.

72  
12

870 Pence.

Then state and work your Question as in the following Work.

2r. d. 2r. 2 l. s. d. q.  
If 24 : 870 :: 257 : Answ. 38 . 16 . 4 . 1

6090  
4350  
1740

384  
00

24) 223590 (9316 Pence.

77/6 = 4 Pence.

216

l. s. d. q.

75 38 . 16 . 4 . 1 the Answer.

72

39

24

150

144

6 Pence, what will 64 1/4 be worth in Farthings.

The



*The Golden Rule; or, Rule of THREE. 77*

The fourth Number being Pence, I reduce them into Shillings by taking  $\frac{1}{12}$  Part, which makes 776 Shillings and 4 Pence, and 776 Shillings divided by 20, which is done by cutting off the last Figure, and taking half of the rest.

QUEST. IV.

If for 3 Weeks Diet I pay 11 Shillings and 3 Pence, what is that a Year? Or, which is the same, if 21 Days require 11 s. 3 d. what will 365 Days require?

Ans<sup>r</sup>. 9 l. 15 s. 6 d.  $\frac{3}{7}$ .

*See the Work.*

~~D.~~ *d.*      *D.*      11 3

21: 135 :: 365: 12

135

25

1825 111095

365 135

21) 10075 (0016 d 35 7

217 49275 (2340 4.01 a, 3m99

43-1065-6d

$$42 \frac{1}{12} 1913 = 0.4.$$

72 9. 15. 6  $\frac{3}{4}$  the Answ.

63

—1—

97-

8472 2001

— Prince.

135 01

QUEST. V.

How many Yards of Velvet at 13 s. 4 d. the Yard, will 136 l. 12 s. buy? *Ans.* 204 Yards, and  $\frac{1}{8}$  Parts.

*See the following Work.*

L

13.

# 78 The Golden Rule; or, Rule of THREE.

|       |    |       |    |                               |
|-------|----|-------|----|-------------------------------|
| s.    | d. | l.    | s. |                               |
| 13    | 4  | 136   | 12 | Then say,                     |
| 12    |    | 20    |    |                               |
| <hr/> |    | <hr/> |    | pen. yd. pence.               |
| 30    |    | 2732  |    | If 160 : 1 :: 32784 :         |
| 13    |    | 12    |    |                               |
| <hr/> |    | <hr/> |    | 160) 32784 (204 $\frac{2}{3}$ |
| 160   |    | 5464  |    |                               |
|       |    | 2732  |    | 320                           |
|       |    | <hr/> |    | <hr/>                         |
|       |    | 32784 |    | 784                           |
|       |    |       |    | 640                           |
|       |    |       |    | <hr/>                         |
|       |    |       |    | 144 36 18 9                   |
|       |    |       |    | <hr/>                         |
|       |    |       |    | 160 40 20 10                  |

## QUEST. VI.

A Soldier's weekly Pay, which is 3 Shillings and 5 Pence, is forborn for 3 Years, 9 Months and 10 Days, what is then due? *Anfw.* 33 l. 2 s. 4 d.  $\frac{1}{7}$ .

*See the Work.*

|           |    |                                            |       |
|-----------|----|--------------------------------------------|-------|
| s.        | d. | 3 Y. : 9 M. :: 10 Days.                    |       |
| 3         | 5  | 365                                        | 28    |
| 12        |    | <hr/>                                      | <hr/> |
|           |    | 1095                                       | 252   |
| 41 Pence. |    | 252                                        | <hr/> |
|           |    | 10                                         | <hr/> |
|           |    | 1357 Days.                                 |       |
|           |    | <hr/>                                      | <hr/> |
|           |    | Pence.                                     |       |
|           |    | 7948 $\frac{1}{7}$                         |       |
|           |    | 66 2 4 d.                                  |       |
|           |    | <i>Anfw.</i> 33 l. 2 s. 4 d. $\frac{1}{7}$ |       |

## QUEST.

# *The Golden Rule; or, Rule of THREE. 79*

## QUEST. VII.

If 20 Men do a Piece of Work in 60 Days, in how many Days will 30 Men do the same Work? *Answ.* 40 Days.

*See the Work.*

M. D. M.

20 : 60 :: 30 :

20

30) 1200 (40  
120

00

This Question, and some that follow, are by most Authors esteemed as Questions of *The Rule of Three Inverse*; but we will not confound the Learner with such needless Differences; for we shall make no Distinction between *The Rule of Three Direct*, and *Inverse*. The Rule you have for working of your Question being sufficient in all Cases: For here I consider that the fourth Number sought will be less than the second, because 30 Men will needs require less time than 20 Men; wherefore I multiply the middle Number by the less Extream, and divide by the greater, and the Answer is, as in the Work.

## QUEST. VIII.

How many Yards of Stuff  $\frac{1}{2}$  of a Yard broad, will line a Cloak containing 5 Yards  $\frac{1}{2}$  in Length, and is 1 Yard  $\frac{1}{2}$  broad?

*See the Work.*

Qr. Qr. Qr.

If 5 : 22 :: 3 :

5

3) 110 (36  $\frac{2}{3}$ , or 9 Yards and  $\frac{1}{2}$ .

9

20

18

2

3

2

QUEST.



## 80 The Golden Rule; or, Rule of THREE.

### QUEST. IX.

If 360 Men be in Garrison, and have Provision for 6 Months; but expecting no Relief till the End of 9 Months, how many Men must be turned out, that the Provision may last so much longer? *Answ.* 120 Men.

*Mo. Men. Mo.*  
Say, If 6 : 360 :: 9 :

6

9) 2160 (240 Men to be retained, and the Remainder to 360, (*viz.*) 120 must be turned out.

18

36

36

00

### QUEST. X.

If a Traveller go 160 Miles in 7 Days, when the Day is 16 Hours long; how many Days will he go the same Journey, when the Day is 12 Hours long? *Answ.* in 9 Days and 4 Hours.

*See the Work.*

*Ho. Da. Ho.*

Say, If 16 : 7 :: 12 :

16

12) 112 ( $9\frac{1}{3}$

108

$\frac{4}{12}$  or  $\frac{1}{3}$

But many times you may have a Question of the *Rule of Three* proposed, that may require some Preparation before you can state your Question, either by *Addition*, *Subtraction*, *Multiplication*, or *Division*, &c. As may be seen in the Examples following.

QUEST.



## 82 *The Golden Rule, or, Rule of THREE.*

Find how much it fills more than it empties, by Subtraction, which is 15 Gallons in one Hour.

Gall. H. Gall.

Then say, if 15 : 1 :: 200 :

60 Filling Cock

15) 200 (13  $\frac{1}{3}$

45 Emptying Cock

15

15 Difference.

50

45

$\frac{1}{3}$  or  $\frac{1}{3}$

## QUEST. XIII.

A Butcher sends his Man with 216 Pounds to a Fair, to buy Cattle; Oxen at 11 *l.* Cows at 40 *s.* per Piece, Colts at 1 *l.* 5 *s.* per Piece; Hogs at 1 *l.* 15 *s.* per Piece, and of each a like Number. How many of each must he buy?

*Answ.* 13 of each Sort, and he would have 8 *l.* remaining.

Bring the Price of each Sort of Cattle into Shillings, and by Addition find the Sum of those Shillings, which will be 320 *s.* and 216 *l.* is 4320 *s.* as you may see.

|        |              |                               |            |
|--------|--------------|-------------------------------|------------|
|        | 11 <i>l.</i> | the Price of an Ox, equal to  | 220 Shill. |
| 216    | 2            | the Price of a Cow, equal to  | 40         |
| 20     |              | the Price of a Colt, equal to | 25         |
|        |              | the Price of a Hog, equal to  | 35         |
| Shill. | 4320         |                               | 320        |

Sh. Cat. Sh.

Then say, if 320 : 1 :: 4320 :

1

320) 4320 (13 *Facit.*

320

1120

960

160

## QUEST.



# The Golden Rule; or, Rule of THREE. 83

## QUEST. XIV.

Two Persons, *A* and *B*, depart from one Place, and both go one Road; but *A* goes 3 Days before *B*, and travels 30 Miles a Day; *B* follows after, and travels 50 Miles a Day: How many Miles, and in how many Days Travel will *B* overtake *A*?

First find by *Subtraction* how much *B* exceeds *A* daily; then by *Multiplication* find how many Miles *A* hath travelled at *B*'s setting out; as under

30 *A*'s daily Travel.  
*B* 50  
*A* 30  
 20 Excess.  
 90 Miles which *A* hath travelled at *B*'s setting out.  
 M. D. M.

Then say, If 20 : 1 :: 90 :

He will overtake him at the End of 4 Days and a half; and 9.0 will have travelled 225 Miles. 4.½ the Answer.

## QUEST. XV.

In 460 Pounds how many Shillings, Six-pences, Four-pences, Two-pences, and Pence, of each a like Number, may there be found therein? *Answ.* 4416.

Then say, If 25 : 1 :: 110400 :

460 25) 110400 (4416  
 460  
 20 100  
 12 9200 104  
 6 12 100  
 4 18400 40  
 2 9200 25  
 1 110400 150  
 150  
 25 0

The Proof is easy.

The

*The Golden Rule; or, Rule of THREE repeated.*

The foregoing Questions being well understood and considered, are sufficient for the understanding both how to state and work any Question in the *Rule of Three*: In this Place therefore we will treat of the *Golden Rule Compound*; or, *Rule of Three repeated*.

We shall in the Practice thereof work the Examples given, by so many single *Rules of Three* as the Question admits of; it being most consentaneous to Reason, most intelligible to the young Learner, and many times as quick; besides a great many Questions not admitting of any other way of Work, whereby the Rules before given, without troubling the Learner with any more, will be sufficient for the Purpose; yet here and there, for the Reader's Satisfaction, we shall name the common Way also.

**QUEST. I.**

If the Carriage of 20 Packs from *Manchester* to *London*, which is 136 Miles, cost 16 Pounds; what will the Carriage of 12 Packs from *Manchester* to *Chester* cost, being 28 Miles?

*See the following Work.*

First, I say, if 20 Packs cost 16 Pounds, what will 12 Packs cost? *Answ.* 9 Pounds, 12 Shillings.

| P. | l.  | P.           |
|----|-----|--------------|
| 20 | 16  | 12           |
|    | 12  |              |
|    | 32  |              |
|    | 16  |              |
| 20 | 192 | (9 l. 12 s.) |
|    | 180 |              |
|    | 12  |              |

Then

Then say again; if 136 Miles cost 9 l. 12 s. or 192 Shillings, what will 28 Miles cost? *Ans.* 1 l. 19 s. 6 d.

M. Sh. M.

136 : 192 :: 28

28

1536

384

136) 5376 (39 Sh.

17. 19 s. 6 d.

408

1296

1224

72

12

144

72

864 (8 l.

816

48 6

136 12

If you would work this Question at one Operation by the Rules commonly given, you must take Notice there are five Numbers given to find a sixth in Proportion thereto.

Which Numbers must be so placed as the three first may contain a Supposition, and the two last a Demand; which that you may place right, let the first Term be of the same Denomination with the fourth, the second of the same Denomination with the fifth, and the third with the Term required.

So in the foregoing Question the Numbers will be disposed in the following Order.

M

M



$20 : 136 :: 16 : 12 :: 28$ . Or thus, If  $20 : 16 :: 12$   
 $M. \quad M. \quad M. \quad M.$   
 $136 \quad 28$

Then will your two first Numbers, multiplied together, be the first Number in the single Rule of Three, the third will be the second, and the two last, multiplied together, will be the third; then will your Numbers stand thus, as you see.

If  $2720 : 16 :: 336$   $136$   $28$   
 $16$   $20$   $12$   


---

 $2016$   $2720$   $56$   
 $336$   $28$   


---

 $2720) 5376 (1 l.$   $336$   
 $2720$   


---

 $2656$   
 $20$   


---

 $53120 (19 s.$   
 $2720$   


---

 $25920$   
 $24480$   


---

 The Answer is 1 l. 19 s. 6 d.  $\frac{6}{17}$  as  
 Before.

If you would work this Question by the Rules commonly given, you must take Notice there are five Numbers given to find a Proportion there to.  
 Which Numbers must be so placed as the three first may contain a Supposition, and the two last Demand; which that you may place right, let the first be of the same Denomination with the fourth, the second of the same Denomination with the third, and the third with the Term required.  
 So in the foregoing Question the Numbers will be dis-

$96 | 0 | 48 | 24 | 12 | 6$   


---

 $2720 | 0 | 136 | 68 | 34 | 17$

QUEST.

# Rule of THREE repeated.

83

## QUEST. II.

If 20 Pounds gain 16 Pounds in 15 Months, what Sum of Money will gain 24 Pounds in 3 Months?

First say, if 16 Pounds come from 20 Pounds, what will 24 Pounds come from? *Ans.* 30 Pounds.

$$\begin{array}{r} \text{If } 16 : 20 :: 24 \\ \hline 20 \quad \text{---} \\ 16) 480 \quad (30. \\ \underline{48} \quad \text{---} \\ 00 \end{array}$$

Then I say again, if 15 Months require 30 *l.* what will 3 Months require? *Ans.* 150 *l.* the Number sought.

If 15 Months require 30 Pounds, 3 Months will require more Money, because it is less Time; therefore I multiply by the greater Extream, and divide by the less; and the Answer will be found to be 150 Pounds, as in the Work.

$$\text{If } 15 : 30 :: 3$$

This Question may be otherwise stated, yet wrought by two Operations, as before; for you may say, If 15 Months come from 20 *l.* what will 3 Months? (from more Money, because less Time.) *Ans.* 100 *l.*

$$\begin{array}{r} 15 : 20 :: 3 \\ \hline 15 \quad \text{---} \\ 3) 300 \quad (100 \\ \underline{3} \quad \text{---} \\ 000 \end{array}$$

M 2

Say

Say again, If 16 Pounds come from 100 Pounds, what will 24 come from? *Ans.* 150, the Answer as before.

$$\begin{array}{r} 16 : 100 :: 24 \\ 16) 2400 \quad (150 \end{array}$$

$$\begin{array}{r} 16 \\ \hline \end{array}$$

$$\begin{array}{r} 80 \\ \hline \end{array}$$

$$\begin{array}{r} 80 \\ \hline \end{array}$$

$$\begin{array}{r} 00 \\ \hline \end{array}$$

But if this Question were to be wrought at one Operation, you must place your Numbers as before directed; and seeing the Operation before was after such Manner, as the one Operation was Direct and the other Inverse, the Fashion of your Work will be altered, for you must multiply them cross-wise, viz. the first Number of the first Rank, by the second Number of the third Rank; and the latter Term of the first Rank, by the first Term of the last Rank, setting the Products under their own Multipliers; so will the Product, standing under the first Rank, be your first Number in a *Single Rule of Three Direct*; and the Product under the last Rank will be your third Number, and your middle Number the second.

*See the Work.*

$$\begin{array}{ccccccc} 1 & M. & 1 & M. & 1 & M. & \\ \text{If } 16 : 15 : 20 :: 24 : 3 : \end{array}$$

$$\begin{array}{r} 3 \\ \hline 48 \end{array} \quad \begin{array}{r} 15 \\ \hline 120 \\ 24 \\ \hline 360 \end{array}$$

ye2

s M

Then



# *Rule of THREE repeated.*

89

Then if  $48 : 20 :: 360$

20

48) 7200 (150 l. The Answer as before.

48

240

240

00

## *The Golden Rule COMPOUND.*

I have been the more large in the foregoing Questions, not only to shew the Variety of the Work, but that I might be the shorter in the following Examples: In most of which I shall only state the Question, and give the Answer; leaving the rest to the Exercise of the Learner.

### QUEST. III.

What is the Interest of 672 l. for 7 Years, at Six per Cent. Simple Interest? *Ans.* 282 l. 4 s. 9 d. 2 q.

l. l. l.

First, I say. If  $100 : 6 :: 672$

6

40.32 Interest for one Year.

Secondly, if  $1 : 40.32 :: 7$

7

l. 282.24

20

s. 4.80

12

160

80

d. 9.60

4

q. 2.40

### QUEST.

## QUEST. IV.

What is the Interest of 271. for 5 Months and 11 Days,  
or 151 Days at 6 per Cent. Simple Interest? *Ans.* 10 s. 5 d.

*l. l. l. D. l. D.*  
First, if  $100 : 6 :: 21$  Secondly, if  $365 : 1.26 :: 151$

*Facit* 1.26

126

630

126

365) 190.260 (521

1825

10.420

776

12

730

5.040

460

## QUEST. V.

If 12 Rod of Ditching be wrought by 2 Men in 6  
Days, how many Rod shall be wrought by 8 Men in 24  
Days? *Ans.* 192 Rod.

*M. R. M. R.*

First, If  $2 : 12 :: 8 : \text{Facit}$  48

*D. R. D. R.*

Second, If  $6 : 48 :: 24 : \text{Facit}$  192

## QUEST. VI.

If 20 Dogs, for 30 Groats,  
Go 40 Weeks to Grass;  
How many Hounds for 60 Crowns,  
May Winter in that Place?  
*Ans.* 2000 Hounds.

# Rule of THREE repeated.

91

## The Operation.

C. D. C. W. D. W.  
If 2 : 20 :: 60 Then if 40 : 600 :: 12  
60 40

2) 1200 (600 12) 24000 (2000

12

00

This Question is the same as if one should say, If 20 Dogs for 2 Crowns be kept 40 Weeks, how many Dogs will 60 Crowns keep the Remainder of the Year, or Winter Quarter, which is 12 Weeks?

## QUEST. VII.

If 12 Men build a Wall 30 Feet long, and 6 Feet high, and 3 Feet thick, in 15 Days; in how many Days will 60 Men make a Wall 300 Feet long, 8 Feet high, and 6 Feet thick? *Ans.* In 80 Days.

F.l. D. F.l. D.  
First say, If 30 : 15 :: 300 : 150  
F.b. D. F.b. D.  
Then, If 6 : 150 :: 8 : 200  
F.t. D. F.t. D.  
Again, If 3 : 200 :: 6 : 400  
M. D. M. D.  
Lastly, If 12 : 400 :: 60 : 80

## QUEST. VIII.

If 35 Ells at Vienna make 24 at Lyons, and 3 Ells at Lyons make 5 Ells at Antwerp, and 100 Ells at Antwerp 125 at Frankfort; how many Ells at Frankfort make 42 at Vienna? *Ans.* 60 Ells at Frankfort.



*Ant. Frank. Ant. Frank.*

First, If  $100 : 125 :: 5 : 6\frac{1}{4}$

*Ly. Frank. Ly. Frank.*

2. If  $3 : 6\frac{1}{4} :: 24 : 50$

*Vien. Frank. Vien. Frank.*

3. If  $35 : 50 :: 42 : 60$

(Or)

*Vien. Ly. Ly. Ant. Ant. Frank. Vien.*

$35 \cdot 24 \cdot 3 \cdot 5 \cdot 100 \cdot 125 \cdot 42$

Then you may see the 1st and 7th Term are of one Denomination, the 2d and 3d of another, the 4th and 5th of another, and the 6th and 8th of another; wherefore multiply the 2d, 4th, 6th and 7th continually for your Dividend, and the 1st, 3d and 5th multiplied together, will be your Divisor, and the Quotient will be the Answer to the Question, (*viz.*) 60 at Frankfort.

$$\begin{array}{r}
 24 \\
 35 \\
 5 \\
 3 \\
 \hline
 120 \\
 125 \\
 \hline
 600 \\
 240 \\
 120 \\
 \hline
 15000 \\
 42 \\
 \hline
 30000 \\
 60000 \\
 \hline
 630000 \text{ Dividend.}
 \end{array}
 \qquad
 \begin{array}{r}
 10500 \text{ Divisor.} \\
 6300100 (60) \\
 630 \\
 00 \\
 \hline
 \end{array}$$

By the way, we may observe, that in the working the Questions in the *Rules of Three* foregoing, we have continually used Multiplication before Division, though it be not out of any Necessity: But seeing Fractions are not yet learned, and in dividing there is often a Remainder,

## Contractions in the Rule of THREE. 93

we do it to avoid the Trouble of having a Fraction to multiply, or else we may as well divide the middle Number by that Number which is the Dividend, and multiply that Quotient by the other Extream, the Product is the Answer to the Question, as in the other Way.

### EXAMPLE.

If 13 Packs of Wool cost 65 Pounds, what will 142 Packs of the same Wool cost? *Ans.* 710*l.*

|               |       |     |
|---------------|-------|-----|
| P. l.         | P.    | 142 |
| If 13 : 65 :: | 142 : | 5   |
| 13) 65 (5     |       | —   |
| 65            |       | 710 |
| —             |       |     |

Here I divided 65 by 13, the Quotient 5 I multiplied 142 by, and the Product, to wit, 710 Pounds is the *Answer*.

## Contractions in the Rule of THREE.

This being considered, you may oftentimes contract your Work in *Questions of the Rule of Three*.

And first, if at any time you have a Question given in *The Rule of Three Repeated*, and the first and second Number in every Operation be the same, you may contract your Work, by dividing the second Number by the first, and the Quotient will be a common Multiplier, by which you may multiply all your third Numbers, and those Products will be the Numbers sought. And thus will all your Divisions be saved, except one, and that commonly a small one.

### EXAMPLE.

*A*, *B*, *C*, and *D*, have 100 Pounds Sterling to be divided among hem, in such sort, that as oft as *A* hath 3 Pounds, *B* must have 5 Pounds; and as oft as *B* hath 5 Pounds, *C* must have 7 Pounds; and as oft as *C* hath 7 Pounds, *D* must have 10 Pounds; what must each have?

N

Add

# 94. Contractions in the Rule of THREE.

to find the Answer to a Question, having a Rule of Three, or such other  
- (multiplied) Add the Proportions into one Sum, and say,

3 1. 1. 4  
5 25 : 100 : 3  
7 25 : 100 : 7  
10 25 : 100 : 10  
— 25 : 100 : 4  
25

Or shorter, thus, if 25 : 100 : 3  
— 7 : 10

25) 100 (4 4  
100 3 5 0  
— 12 for A. 20 for B.

A 12 4 4  
B 20 7 10  
C 28 — —  
D 40 28 for C. 40 for D.  
100 for Proof

In this Example you may see there are 3 Divisions  
sayed, and that Division you have, but a small one; and  
therefore will prove of excellent Use in the Rule of Fel-  
lowship and Allegation, where the first and second Num-  
ber in every Operation is commonly the same; so here-  
after, we will call this Method the contracted Way in  
Fellowship.

Sometimes a Question of the Rule of Three may be per-  
formed by Multiplication only.  
- Sometimes by Division only.  
Sometimes by two Multiplications.  
Sometimes by two Divisions.  
And, sometimes by a Smaller Multiplication and Divi-  
sion than your given Numbers allow of.

16A

If



# Constructions in the Rule of THREE. 89

If at any time your Divisor, with either of the other Numbers, may be severally divided by some common Measure, without leaving any Remainder, and your Divisor come to be an Unit, the Answer will be given by Multiplication only; as in the following Example.

If 6 Gros of Incle cost 15 *l*. what will 48 cost?

*Ans*w. 120 *l*.

Gr. *l*. — Gr.

6 : 15 :: 48 :

$\frac{1}{2}$  1 : 15 :: 8

*Ans*w. 120 *l*.

Here  $\frac{1}{2}$  of 6 is 3, of 48 is 24, and 24 times 5 is 120 Pounds; the Answer.

But if either of the other Numbers cannot be so divided, the Work may be performed by Division only; as in the following Example.

If 18 Gros cost 12 *l*. what will 6 Gros cost?

*Ans*w. 4 *l*.

Gr. *l*. Gr.

18 : 12 :: 6 :

$\frac{1}{3}$  3 : 12 :: 1 :

3 ) 12 ( 4

12

0

Here I take  $\frac{1}{3}$  of 18, which is 6, and a 6th Part of 6 is 1; then divide 12 by 3, gives 4 Pounds; the Answer to the Question.

If your Divisor be exactly contained in both your other Numbers, the Question may be answered by two Multiplications; as in the Example following.

## 96 Contractions in the Rule of THREE.

If 3 Grofs cost 9 l. what will 12 Grofs cost?

*Anfw. 36 l.*

$$\begin{array}{r} \text{Gr. 1.} \quad \text{Gr. 12.} \\ 3 : 9 :: 12 : 36 \end{array}$$

4

12

3

$$\begin{array}{r} 36 \\ 3 \end{array}$$

Here the 3d Part of 9 is 3, of 12 is 4; multiply 3 by 4 gives 12, and that by 3 gives 36; the Answer.

If you would use two Divisions, divide your Divisor by your second Number, and the 3d by that Quotient, which gives the Answer.

### EXAMPLE.

If 9 gives 3, what will 45 give?

*Anfw. 36 l.*

$$\begin{array}{r} 3 \overline{) 9} \quad (3) \quad 45 \overline{) 15} \\ 9 \quad 3 \quad 15 \\ \hline 0 \quad 0 \quad 0 \end{array}$$

So dividing 9 by 3, quotes 3, and by that dividing 45, quotes 15, the Answer.

Sometimes you must use both Multiplication and Division, yet but small ones.

E X.

# Contractions in the Rule of THREE 97

## EXAMPLE.

If 48 Yards of Linnen Cloth cost 3*l*. 12*s*. what will 112 Yards cost? *Ans*w. 8*l*. 8*s*.

*Yd.* *s.* *Yd.* *l.* *s.*  
 48 : 72 :: 112 : 3 12  
 24 : 72 :: 56 : 20  
 12 : 72 :: 28 : 12  
 6 : 72 :: 14 : 60  
 3 : 72 :: 7 : 12  
 3) 504 (168

3 12 82 20 18 24 24 0

You might have contracted your Work more still, by taking  $\frac{1}{8}$  of the first and last, at first, and then  $\frac{1}{2}$  of that; which would have been the same; as you may see.

The *Double*, or *Compound Rule of Three*, may also be greatly contracted by a Method of managing Vulgar Fractions, which the Reader will find explained in page 116 following.—Let us, for Example, take the first Question in the Double Rule of Three, which is resolved at one Operation page 86 foregoing. The two first Numbers are there multiplied together for a first Number or Divisor, and the two last for a third Number, which, by the *Golden Rule*, is to be multiplied by the second: And consequently, the three last Numbers multiplied together form the Dividend, and the Quotient arising from thence answers the Question. This being premised, we shall proceed, according to this short Method, to solve the Question, which in page 86 stands thus.

P.



## 98 Contractions in the Rule of THREE

*P. 1. P. 2.*  
 If 20 : 136 :: 12 : 28  
*M. M.*  
 136 28  
 The two first Numbers, viz. 20 and 136, are to be multiplied for a Divisor, and the three last, viz. 16, 12 and 28, for a Dividend, and the Quotient arising from thence is the Answer. That is  $\frac{16 \times 12 \times 28}{20 \times 136}$  will answer the Question. This Fraction reduced, according to the Rule given in page 116, will be  $\frac{6 \times 28}{5 \times 17}$  or  $\frac{168}{85}$ ; the Value of which is easily found, as follows.

85) 168 (1 83 That is 1 l. 19 s. 6 d.  $\frac{30}{85}$  or  $\frac{6}{17}$ ,  
 85 the same as in page 86.

$$\begin{array}{r} 83 \\ 83 \\ 20 \\ \hline 1660 \text{ (19 s.} \\ 85 \end{array}$$

$$\begin{array}{r} 810 \\ 765 \\ \hline 45 \\ 12 \end{array}$$

$$\begin{array}{r} 90 \\ 45 \\ \hline 540 \text{ (6 d.} \\ 510 \\ \hline 30 \end{array}$$

### Proof of the Golden Rule.

We will shew you how to prove the Rule of Three, and to conclude this Rule.  
 If 4 Numbers be proportional, the Product of the two Means is equal to the Product of the two Extremes.

Hence

## Proof of the Golden Rule. 99

Hence to prove your Work, multiply the 4th Number found by the first Number, and if that Product be equal to the Product of the 2d by the 3d, the Work is right, else not.

So if 8 Yds. cost 16 l. what will 45 Yds. cost? *Ans.* 90 l.

$$\begin{array}{r}
 \text{r.} \quad \text{l.} \quad \text{r.} \\
 8 : 16 :: 45 \\
 \hline
 45 \\
 80 \\
 64 \\
 \hline
 8) 720 \text{ (90)} \\
 72 \\
 \hline
 00
 \end{array}$$

Then the 4 proportional Numbers will be,

$$\begin{array}{r}
 8 : 16 :: 45 : 90 \\
 \hline
 45 \quad 8 \\
 80 \quad 720 \text{ the Prod. of the 1 and 4.} \\
 64 \\
 \hline
 720 \text{ the Product of the 2 and 3.}
 \end{array}$$

You see the Product of the 1st and 4th is equal to the Product of the 2d and 3d, which shews your Work to be right.

Hence, if of 4 Numbers, the 1st be to the 2d as the 3d is to the 4th, so those 4 Numbers shall be proportional.

But if your 3d Number be less than the 1st, and require more; or more, and require less; then the Product of your first and second will be equal to the Product of your third and fourth.

### EXAMPLE.

If 12 Men do a Piece of Work in 16 Days, in how many Days will 24 Men do the same Piece of Work?

If





A Table of the Aliquot Parts of a Shilling.

|     |   |      |     |    |       |
|-----|---|------|-----|----|-------|
| For | 1 | Take | one | 12 | Part. |
|     | 2 |      | one | 6  |       |
|     | 3 |      | one | 4  |       |
|     | 4 |      | one | 3  |       |
|     | 6 |      | one | 2  |       |

The Use of this Table is easy; for you may see that for 1 Penny you must take one 12th Part; for 1 Penny Half-penny, one 8th Part; for 2 Pence, one 6th Part; and so of any other.

Example I.

Here I said,  $\frac{1}{2}$  of 67 is 33, At 1 Penny the Yard, what will 67 Yards cost? the last Figure, 7, the rest is Pounds, and the Answer is 2l. 16s.

Ans. 2l. 16s.

II.

In this Example I took  $\frac{1}{4}$  of 67 is 16, At 1 Penny the Yard, what will 67 Yards cost? the last Figure, 7, the rest is Pounds, and the Answer is 4l. 4s.

III.

Here I took a 6th Part, At 2 Pence the Yard, what will 67 Yards cost? cutting off as before, and the Answer is 5l. 12s.

108  
112  
220

Ans. 5l. 12s.

O

Here

Here I took  $\frac{1}{4}$  Part, which made 168 s. equal to 8 l. 8 s.

|   |     |
|---|-----|
| 8 | one |
| 0 | one |
| 4 | one |
| 3 | one |

At 3 Pence the Yard, what will 672 Yards cost?

$\frac{1}{4}$  168

Ans. 8 l. 8 s.

Here I took one third Part, which made 224 s. equal to 11 l. 4 s. the Answer.

At 4 Pence the Yard, what will 672 Yards cost?

$\frac{1}{3}$  224

Ans. 11 l. 4 s.

Here I took  $\frac{1}{6}$  for 6 Pence, which made 336 s. equal to 16 l. 16 s. the Answer.

At 6 Pence the Yard, what will 672 Yards cost?

$\frac{1}{6}$  336

Ans. 16 l. 16 s.

After this Method may any Question consisting of the Aliquot Parts of a Shilling be resolved.

But if your Question consists of un-aliquot Parts, as 5 d. 7 d. 8 d. 9 d. 11 d. &c. then it must be divided into Aliquot Parts, as 5 d. into 3 d. and 2 d.; 7 d. into 4 d. and 3 d.; or 6 d. and 1 d.; 9 d. into 6 d. and 3 d. or 3 Three-pences, and so of any other, as in the Examples following may be seen.

First, I took  $\frac{1}{4}$  of 672 for 3 d. makes 168 Shillings; then I took  $\frac{1}{8}$  of 672 for 2 d. makes 112 Shillings; which two Numbers added together, make 280 Shillings, equal to 14 l. the Answer.

At 5 Pence the Yard, what will 672 Yards cost?

$\frac{1}{4}$  168

$\frac{1}{8}$  112

280

Ans. 14 l.

Here

Here I took, first  $\frac{1}{4}$  for 4d. then  $\frac{1}{4}$  for 3d. which added together, makes 392 Shillings equal to 19 l. 12 s. the Answer.

If I had taken, first  $\frac{1}{2}$  for 6d. then  $\frac{1}{4}$  for 1d. or  $\frac{1}{8}$  of 6d. for one Penny, it had been the same; as you may try at your Leisure.

Here for 6d. I took  $\frac{1}{2}$  of the Number given, and for 3d.  $\frac{1}{4}$  of the same Number, or  $\frac{1}{2}$  of 6d. for 3d. both being the same; as you may see, and the Answer will be 5 l. 8 s. See the Work.

Here first I took one half for 6d. and one half of that for 3d. and  $\frac{1}{2}$  of 3d. for 1d.  $\frac{1}{2}$ , and  $\frac{1}{2}$  of 1d.  $\frac{1}{2}$  for 3q. which is just 11d. 1q. which Sums added together, and divided by 20, as before, give 35 l. 5 s. the Answer.

II. At 7 Pence the Yard, what will 672 Yards cost?

$$\begin{array}{r} \text{Number given for } 1 \text{ Pence} \\ 672 \\ \times 7 \\ \hline 4704 \end{array}$$

Ans. 19 l. 12 s.

III. At 9 Pence the Yard, what will 144 Yards cost?

$$\begin{array}{r} \frac{1}{2} 72 \\ \frac{1}{4} 36 = \frac{1}{2} \text{ of } 72 \\ \hline 108 \end{array}$$

Ans. 5 l. 8 s.

IV. At 11 d. 1 q. the Yard, what will 752 Yards cost?

$$\begin{array}{r} \frac{1}{2} 376 \\ \frac{1}{4} 188 \\ \frac{1}{2} 94 \\ \frac{1}{4} 47 \\ \hline 705 \end{array}$$

Ans. 35 l. 5 s.

We will now proceed to the Questions that consist of a Shilling, and some Number of Pence and Farthings beside, that the Learner may understand all Varieties.



104. *The Rule of PRACTICE.*

In this Question I let the Number given stand for a Shilling, and only take an  $\frac{1}{8}$  Part for 1 d.  $\frac{1}{2}$ , and adding them together, gives 162 Shillings, equal to 8 l. 2 s. the Answer.

At 32  $\frac{1}{2}$  the Yard, what will 144 Yards cost?

$\frac{1}{8}$  18

$\frac{1}{8}$  18

$\frac{1}{8}$  18

$\frac{1}{8}$  18

$\frac{1}{8}$  18

$\frac{1}{8}$  18

$\frac{1}{8}$  18

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$\frac{1}{8}$  18

$\frac{1}{8}$  18

$\frac{1}{8}$  18

$\frac{1}{8}$  18

$\frac{1}{8}$  18

It is evident, it will cost 143 Shillings and 143 d.  $\frac{1}{2}$ ; wherefore I let it stand for a Shilling, and taking  $\frac{1}{4}$  Part for 3 d. and  $\frac{1}{2}$  of 3 d. for 3 Half-pence, adding all together, makes 196 Shillings and 7 d.  $\frac{1}{2}$ , equal to 9 l. 16 s. 7 d.  $\frac{1}{2}$  the Answer.

At 16 d.  $\frac{1}{2}$  the Yard, what will 143 Yards cost?

$\frac{1}{4}$  35

$\frac{1}{4}$  35

$\frac{1}{4}$  35

$\frac{1}{4}$  35

$\frac{1}{4}$  35

$\frac{1}{4}$  35

$\frac{1}{4}$  35

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$\frac{1}{4}$  35

$\frac{1}{4}$  35

$\frac{1}{4}$  35

$\frac{1}{4}$  35

$\frac{1}{4}$  35

Here I let it stand for 1 s. then taking  $\frac{1}{2}$  for 6 d. and  $\frac{1}{2}$  of 6 d. for 3 d. and  $\frac{1}{2}$  of 3 d. for 1 d.  $\frac{1}{2}$ , the Sum of all, which is 270 Shillings, equal to 13 l. 10 s. the Answer.

At 22 d.  $\frac{1}{4}$  the Yard, what will 144 Yards cost?

$\frac{1}{2}$  72

$\frac{1}{2}$  72

$\frac{1}{2}$  72

$\frac{1}{2}$  72

$\frac{1}{2}$  72

$\frac{1}{2}$  72

$\frac{1}{2}$  72

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$\frac{1}{2}$  72

$\frac{1}{2}$  72

$\frac{1}{2}$  72

$\frac{1}{2}$  72

Here follow some more Questions of diverse Natures, for the further Exercise of the Learner.

## I.

For 3 d. I took  $\frac{1}{4}$  Part, and for a Farthing  $\frac{1}{12}$  of that, and for  $\frac{1}{2}$  a Farthing, I took  $\frac{1}{2}$  of the Farthing, and for the Quarter of the Farthing,  $\frac{1}{2}$  of the  $\frac{1}{2}$  Farthing, which added together, make 41 s. and 3 d. equal to 2 l. 1 s. 3 d.

At 3 d. Farthing,  $\frac{1}{2}$  Farthing,  $\frac{1}{4}$  Farth. the Yard, what will 144 Yards cost?

$\frac{1}{4}$  36

$\frac{1}{4}$  36

$\frac{1}{4}$  36

$\frac{1}{4}$  36

$\frac{1}{4}$  36

$\frac{1}{4}$  36

$\frac{1}{4}$  36

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$\frac{1}{4}$  36

$\frac{1}{4}$  36

$\frac{1}{4}$  36

$\frac{1}{4}$  36

$\frac{1}{4}$  36

Ans. 2 l. 1 s. 3 d.

# The Rule of PRACTICE.

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II.  
Here I took for 3 d. twice, At 6 d. 1 q. a Yard, what  
and for 1 Farthing,  $\frac{1}{12}$  Part will 41 Yards cost?  
of 3 d. which added, makes  
21 s. 4 d. 1 q. or 1 l. 1 s. 4 d.  
1 q.

$$\begin{array}{r} 10 \ 3 \\ 10 \ 3 \\ 00 \ 10 \\ \hline 21 \ 4 \ 1 \end{array}$$

Ans. 1 l. 1 s. 4 d. 1 q.

III.  
Here I took  $\frac{1}{8}$  Part for At 3 Farthings the Ell, what  
1 d.  $\frac{1}{2}$ , and  $\frac{1}{2}$  of that is equal to will 67  $\frac{1}{2}$  Ells cost?  
420 s. and the Answer will  
be 21 l. 00 s. 3 d. 3 q.

$$\begin{array}{r} \frac{1}{8} \ 840 \ 3 \ 3 \\ \hline \frac{1}{2} \ 420 \ 3 \ 3 \end{array}$$

Ans. 21 l. 00 s. 3 d. 3 q.

IV.  
First, I reduced the Yards At 3 d.  $\frac{1}{2}$  the Ell, what  
into Ells, Facit 582  $\frac{2}{3}$  Ells; will 728 Yards cost?  
then for 2 d. I took a 6th  
Part, and for the 1 d.  $\frac{1}{2}$  Part:  
Lastly, for the  $\frac{1}{2}$  I took  $\frac{1}{2}$  of the Price of the  
Ell twice; and the Answer  
will be, as in the Work, viz.  
8 l. 9 s. 10 d. 1 q.  $\frac{2}{3}$ .

$$\begin{array}{r} 4 \\ 2912 \\ \hline \frac{1}{2} \ 582 \ \frac{2}{3} = \text{Ells.} \\ \hline 97 \ d. \ 9. \\ 72 \ 9 \ 2 \ \frac{2}{3} \\ \hline 2 \ \frac{2}{3} \end{array}$$

Ans. s. 169 10 1  $\frac{2}{3}$  or  
8 l. 9 s. 10 d. 1 q.  $\frac{2}{3}$

We shall now proceed to Questions relating to Aliquot  
Parts of a Pound; to which Purpose take the following  
Table.

Aliquot

## II. Aliquot Parts of a Pound.

| Sh. | Pence | Take              |
|-----|-------|-------------------|
| 1   | 0     | one 20            |
| 1   | 8     | one 12            |
| 2   | 0     | one 10            |
| 2   | 6     | one 8             |
| 3   | 4     | one 6             |
| 4   | 0     | one 5             |
| 5   | 0     | one 4             |
| 6   | 8     | one 3             |
| 10  | 0     | one $\frac{1}{2}$ |

## III. Examples follow.

(1.)  
At 1 s. per Yard, what  
 $\frac{1}{20}$  144 Yards?  
Answ. 7 l. 4 s.

(2.)  
At 1 s. 8 d. the Yard, what  
 $\frac{1}{12}$  144 Yards?  
Facit 12 l. the Answer.

(3.)  
At 2 s. Yard, what 67  $\frac{1}{2}$  Yards;  
 $\frac{1}{10}$  Part is 67  $\frac{1}{2}$   
Answ. 67 l. 4 s.

(4.)  
At 2 s. 6 d. what 172 Yards?  
 $\frac{1}{3}$  is 21  $\frac{1}{3}$   
Answ. 21 l. 10 s.

(5.)  
At 3 s. 4 d. the Yard, what 751  
Yards?  
 $\frac{1}{8}$  Part is 125  $\frac{1}{8}$   
Answ. 125 l. 3 s. 4 d.

(6.)  
At 4 s. per Yard, what 176  
Yards?  
 $\frac{1}{5}$  Part is 35  $\frac{1}{5}$   
Answ. 35 l. 4 s.

(7.)  
At 5 s. Yard, what 725 Yards?  
 $\frac{1}{4}$  Part is 181  $\frac{1}{4}$   
Answ. 181 l. 5 s.

(8.)  
At 6 s. 8 d. the Yard, what 176  
Yards?  
 $\frac{1}{3}$  Part is 58  $\frac{2}{3}$   
Answ. 58 l. 13 s. 4 d.

(9.)  
At 10 s. Yard, what 144 Yards?  
 $\frac{1}{2}$  Part is 72  
Answ. 72 l.



If your Question consist not of Aliquot Parts, divide it into such, the Sum of which will be the Answer to the Question; as in the following Examples may more fully appear.

(1.)  
At 3s. 2d. what will 144 Yds. cost?  
 $\frac{1}{10}$  for 2 Shill. is 14 l. 8 s.  
 $\frac{1}{10}$  for 1 Shill. or } is 7 l. 4 s.  
 $\frac{1}{2}$  of 2s. for 1 s. }

The Sum is the Ans. 21 l. 12 s.

(2.)  
At 7 s. 10 d. what will 144 Yards cost?  
 $\frac{1}{4}$  Part for 5 Shillings is 36  
 $\frac{1}{10}$  for 2 Shillings 14 8

The Sum is the Ans. 50 8

(3.)  
At 15 s. 6 d. C. what 721 C. cost?  
 $\frac{1}{10}$  for 10 Shillings is 360 10  
 $\frac{1}{2}$  of 10s. for 5 s. is 180 5  
 $\frac{1}{10}$  of 5s. for 6 d. is 18 0 6

The Sum is the Ans. 558 15 6

(4.)  
At 11 s. 4 d. the Gr. what 150 Gross cost?  
 $\frac{1}{10}$  for 10 Shillings is 75  
 $\frac{1}{10}$  of 10s. for 1 s. is 7 10  
 $\frac{1}{3}$  of 1 s. for 4 d. is 2 10

The Sum is the Ans. 85 l.

(5.)  
At 2 s. 4 d.  $\frac{1}{2}$  Pound, what 141 Pounds cost?  
 $\frac{1}{10}$  for 2 s. is 14 2 0  
 $\frac{1}{10}$  of 2 s. for 4 d. is 2 7 0  
 $\frac{1}{8}$  of 4 d. for 2 q. is 0 5 10 $\frac{1}{2}$

The Sum is the Ans. 16 14 10 $\frac{1}{2}$

(6.)  
At 17 s. 6 d. the Bund. what 375 Bundles cost?  
 $\frac{1}{10}$  for 10 s. is 187 10 0  
 $\frac{1}{2}$  of 10s. for 5 s. is 93 15 0  
 $\frac{1}{2}$  of 5 s. for 2 s. 6 d. is 46 17 6

The Sum is the Ans. 328 92 6

If your Question consist of Shillings and Pence, as in the last, you may multiply by the Number of Shillings, and take the correspondent Aliquot Parts for the Pence, according to the first Table; and from the Sum cutting off the last Figure, and taking half the rest, the Answer will be the same as in the foregoing Method; and in some particular Cases may be more convenient, and oftentimes more easy.

## EXAMPLES.

At 7 s. 1 d. the Ell, what will 144 Ells cost? (1.)  
At 9 s. 9 d. what 141 Yards? (3.)

Multiply by 7

Product 1008  
1/2 of 144 is 12 for 1 Penny.

Sum is 102/0  
51 l. the Answer.

At 17 s. 4 d. 1/2 what 172 Yds? (2.)  
Multiply by 17

Product 2924  
1/2 of 172 for 4 d. is 57 4  
2981 4

Answer (0) 149 l. 1 s. 4 d.

Product is (1.) 1269  
1/2 of 141 for 6 d. is 70 6  
1/2 of that for 3 d. is 35 3  
Sum is 137 4 9

Answer 68 l. 14 s. 9 d.

At 1 l. 14 s. 9 d. 1/2 the Yard, what will 144 Yds. cost? (4.)  
Multiply by 34  
576  
432

Product is 4896 s.  
1/2 of 144 for 6 d. is 72  
1/2 of last for 3 d. is 36  
1/2 of that for 2 d. is 6  
Sum is 501 0  
Answer 250 l. 10 s.

If your Question consist of Shillings only, you may contract your Work thus. If your Shillings be even, multiply your Number given by half the Number of Shillings; the first Figure to the Right-hand in your Product, is a double Number of Shillings; and in your Operation, ought to be set apart in the Place of Shillings, the rest is Pounds.

(1.)  
At 16 s. the Yard, what will  
672 Yards cost?  
Multiply (16) 672  
By 10 of 16 (10) 8  
Pr. with Sh. apart is 537.12  
Answer 537. 12

(2.)  
At 6 s. the Yard, what will  
172 Yards cost?  
172  
Answer 103. 4

(3.)  
At 12 s. the Yard, what will  
172 Yards cost?  
Multiply by (1) 172  
Pr. with Sh. apart is 103.4  
Answer 103. 4

(4.)  
At 24 s. the Yard, what will  
125 Yards cost?  
125  
Answer 103. 4  
Multiply by 7

Or you may multiply as usual; and when you have finished your Operation, cut off your last Figure, doubling it for Shillings, and making the rest Pounds.

(1.)  
At 12 s. the Yard, what will  
144 Yards cost?  
144  
Multiply by 10  
Answer 867. 8 s.

(2.)  
At 8 s. the Bundle, what will  
172 Bundles cost?  
172  
Multiply by 4  
Answer 687. 6 s.

But if your Number of Shillings be odd, work for the greatest even Number of Shillings therein, and for the odd Shilling take the 20th Part of the given Number; those Results added together, give the Answer.

At E X.



# THE RULE OF PRACTICE

| EXAMPLE.                                    |                                             |
|---------------------------------------------|---------------------------------------------|
| (1.)                                        | (2.)                                        |
| At 17 s. the Yard what will 172 Yards cost? | At 19 s. the Yard what will 144 Yards cost? |
| Mult. for 16 s. by                          | Mult. for 18 s. by                          |
| Product is 137 12                           | Product 129.6                               |
| 16 for 17 s. is 112                         | 18 for 19 s. is 7.2                         |
| Sum and Answer 146 l. 4 s.                  | Sum 136.8                                   |
| Answer 146 l. 4 s.                          | Answer 136 l. 16 s.                         |

If your Question consist of Pounds, Shillings and Pence; for the Pounds multiply, and for the Shillings and Pence work by the former Rules.

## EXAMPLE

|                                                            |                                                                      |
|------------------------------------------------------------|----------------------------------------------------------------------|
| (1.)                                                       | (2.)                                                                 |
| At 2 l. 17 s. 5 d. the Hundred what will 144 Hundred cost? | If a Pack of Cotton cost 11 l. 11 s. 11 d. what will 111 Packs cost? |
| Multiply by                                                | Same one Fig. nearer                                                 |
| Product 288                                                | Product for 11 l. is 221                                             |
| $\frac{1}{2}$ of 144 for 10 s. is 72                       | $\frac{1}{2}$ for 11 s. is 61.1                                      |
| $\frac{1}{4}$ of that for 5 s. is 36                       | $\frac{1}{4}$ of 11 s. for 11 d. is 5.1.9                            |
| $\frac{1}{8}$ of 144 for 2 s. is 14 8                      |                                                                      |
| $\frac{1}{16}$ of 144 for 1 s. is 9                        |                                                                      |
| The Sum 413 l. 8 s.                                        | 1287.2.9                                                             |
| Answer 413 l. 8 s.                                         | Answer 1287 l. 2 s. 9 d.                                             |

If the Price of one be given, and the Price of any other Number be required, together with  $\frac{1}{2}$ ,  $\frac{1}{4}$ ,  $\frac{1}{8}$ , or any other Part, you must work as before for the Integral Part, and for the Fractional Part take such a Part of the given Price; the Total Sum of which Part will be the Answer to the Question, as in the following Examples may appear.

## Notation of *Kulgar* FRACTIONS. 111

### EXAMPLE.

| (1.)                                                          | (2.)                                                           |
|---------------------------------------------------------------|----------------------------------------------------------------|
| At 4 <i>l</i> . 16 <i>s</i> . 3 <i>d</i> . the Hundred,       | At 3 <i>l</i> . 17 <i>s</i> . 6 <i>d</i> . the Hundred,        |
| what will 34 C. $\frac{1}{4}$ cost?                           | what will 144 C. $\frac{2}{3}$ cost?                           |
| For 4 <i>l</i> . Multiply by 4                                | For 3 <i>l</i> . Mult. by 3                                    |
| Product 136                                                   | Product 432                                                    |
| of 34 for 10 <i>s</i> . is 17                                 | of 3 <i>l</i> . for 15 <i>s</i> . 108                          |
| of 10 <i>s</i> . for 5 <i>s</i> . is 8 10 <i>s</i> .          | of that for 2 <i>s</i> . 6 <i>d</i> . 18                       |
| of 5 <i>s</i> . for 1 <i>s</i> . 3 <i>d</i> . 2 2 6           | of the given Price 18 9                                        |
| of the given Price 2 8 1 $\frac{1}{4}$                        | of that for 14 <i>lb</i> . 9 8 $\frac{1}{2}$                   |
| of that 1 4 0 $\frac{1}{4}$                                   | of that for 7 <i>lb</i> . 4 10                                 |
| The Sum 167 4 8 $\frac{1}{4}$                                 | Sum 560 13 3 $\frac{1}{2}$                                     |
| Answer 167 <i>l</i> . 4 <i>s</i> . 8 <i>d</i> . $\frac{1}{4}$ | Answer 560 <i>l</i> . 13 <i>s</i> . 3 <i>d</i> . $\frac{1}{2}$ |

But if the Fractional Parts cannot conveniently be taken, the quickest, easiest and best Way is performed by the *Decimal Rule of Practice* following.

## The Doctrine of *VULGAR* FRACTIONS.

### Notation of *Vulgar* FRACTIONS.

**W**HAT a *Vulgar Fraction* is, was shewed in the *Introduction*, and so needs no Repetition.

A *Vulgar Fraction* is either *Single* or *Compound*.

A *single Vulgar Fraction*, hath only one *Numerator*, and one *Denominator*, and is either *Proper* or *Improper*.

A *Proper single Fraction*, hath its *Numerator* always less than its *Denominator*; as  $\frac{1}{2}$ ,  $\frac{11}{12}$ ,  $\frac{25}{26}$ , &c.

An *improper single Fraction* is when the *Numerator* is greater than its *Denominator*, as  $\frac{3}{2}$ ,  $\frac{11}{6}$ ,  $\frac{13}{4}$ , &c.

A *compound Vulgar Fraction* is such as hath more *Nume*rators and *Denominators* than one, as  $\frac{1}{2}$  of  $\frac{2}{3}$ , and is easily known

## III. Reduction of Vulgar Fractions.

by having this Word *of*, placed betwixt them; so  $\frac{1}{2}$  of  $\frac{1}{4}$  of  $\frac{1}{2}$ , is a compound Fraction: The Formation is easy: for 7 Pence will be  $\frac{7}{12}$  of  $\frac{1}{10}$  of a Pound, and three Farthings is  $\frac{3}{4}$  of  $\frac{1}{12}$  of  $\frac{1}{10}$  of a Pound.)

From hence proceeds another Number, called a mix'd Number, and consisteth of two Parts, the one Whole, the other Broken: so 3 Yards and 3 Quarters is expres'd in a mix'd Number, thus  $3\frac{3}{4}$ ; others are  $11\frac{1}{2}$ ,  $144\frac{1}{2}$ , &c.

Things commonly expressed by Fractions, or broken Numbers, are the Parts of Coins, Weight, Measure, Time, &c. As Shillings, Pence or Farthings are Fractions in respect of a Pound; so Quarters, Pounds and Ounces are Fractions in respect of a Hundred.

### Reduction of Vulgar Fractions.

Because Addition and Subtraction of Vulgar Fractions cannot well be performed without the Knowledge of Reduction, we will first treat of it, and then of the rest in Order.

By Reduction we bring Fractions into their least equivalent Parts, And into common Denominators,

Or into one Denomination.

By Reduction we find the Value of any Fraction in the known Parts of the Integer.

Reduce whole or mix'd Numbers into improper Fractions, & contra.

As likewise compound Fractions into single.

Of these in their Order.

I. To bring Fractions into their least equivalent Parts, may be performed several Ways; a general Rule for which is either of these that follow.

First, Divide the Denominator by the Numerator, and the Divisor by the Remainder, if any be; thus doing 'till you find nothing remain; your last Divisor is the greatest common Measure sought; or divide the Denominator by the Numerator, and likewise by the Remainder as long as there is any, the last Divisor is your greatest common Measure sought, as before.

By which dividing your Numerator and Denominator, reduceth your given Fraction into its least Parts.

Note, If your last Divisor be an Unit, the Fraction is in its least Terms already.

### EXAMPLE.

Let us find the greatest common Measure of  $\frac{629}{555}$ . Here I divide 629 by 555, remains 74; by which dividing 555, rest 37; by which dividing 74, nothing remains: So is 37 my last Divisor, the common Measure sought.



# Reduction of Vulgar Fractions. 113

See the Work.

555) 629 (1

555

74) 555 (7

518

The first Way.

37) 74 (2

74

0

Facit 37 for the greatest common Measure.

555) 629 (1

555

74) 629 (8

592

The second Way.

37) 629 (17

37

259

259

Facit 37, as before.

Then if you divide 555 and 629 severally by 37, the two Quotients will be 15 and 17, which placed Fractionally, thus  $\frac{15}{17}$ , will be equal in value to the former Fraction, but in its least Terms.

So the greatest common Measure of  $\frac{15}{17}$  will be found to be 1; by which dividing both the Numerator and Denominator, reduceth the Fraction into its least Parts, to wit, 3, and so of any other.

But Fractions may more quickly be abbreviated, if you can descry any Number that will evenly divide both your Numbers, without leaving any Remainder, which in all even Numbers may be done, by halving both as often as you can; if your Numbers end with 5, or a Cypher, it may be done by taking  $\frac{1}{5}$  Part, or  $\frac{1}{10}$  Part; and so in many other.

So  $\frac{40}{80}$  by halving, will be abbreviated into  $\frac{2}{4}$ , and  $\frac{2}{4}$  by taking  $\frac{1}{2}$  will become  $\frac{1}{2}$  the least Parts required, as you may see in the Work.

$\frac{1}{2} \div \frac{1}{2} = 1$   $\frac{1}{2} \div \frac{1}{2} = 1$   $\frac{1}{2} \div \frac{1}{2} = 1$

II. When several Fractions are given to be reduced into other equivalent Fractions, having a common Denominator, use this Rule:

Multiply every Numerator into each Denominator continually, except its own, which shall be new Numerators; then multiply all the Denominators into one another, for a common Denominator, and your Work is finished.

Let

## 2114 Reduction of Vulgar Fractions.

### EXAMPLE.

Let  $\frac{1}{2}$  and  $\frac{2}{3}$  and  $\frac{1}{4}$  be reduced into other Fractions, which shall have one common Denominator.

Multiply 1, 3, and 4 together, *Facit* 12; and 2, 2 and 4, *Facit* 16; and 3, 3 and 2, *Facit* 18; so have you three new Numerators. Next multiply, 2, 3 and 4 into one another. *Facit* 24 for a common Denominator to the former Numerators.

So  $\frac{1}{2}$ ,  $\frac{2}{3}$ ,  $\frac{1}{4}$  will be equal to  $\frac{6}{12}$ ,  $\frac{8}{12}$ ,  $\frac{3}{12}$ .

Reduce  $\frac{1}{2}$ ,  $\frac{2}{3}$ ,  $\frac{1}{4}$ , into a common Denominator, and you will find  $\frac{6}{12}$ ,  $\frac{8}{12}$ ,  $\frac{3}{12}$  equal to  $\frac{1}{2}$ ,  $\frac{2}{3}$ ,  $\frac{1}{4}$  equal to  $\frac{1}{2}$ ,  $\frac{2}{3}$ ,  $\frac{1}{4}$  equal to  $\frac{1}{2}$ , and thus of any other.

III. Fractions of diverse Denominations may be brought into one Denomination, by involving the less into the Parts of the greater, whereby it will become a compound Fraction.

### EXAMPLE.

So if  $\frac{1}{4}$  of a Shilling, and  $\frac{1}{2}$  of a Pound must be brought into the Fraction of a Pound, you may observe that  $\frac{1}{4}$  of a Shilling is  $\frac{1}{20}$  of a Pound, because one Shilling is one twentieth of a Pound; which compound Fraction, when reduced by one of the following Rules, will be  $\frac{1}{80}$  of a Pound; so have you both in one Denomination, as was required.

So  $\frac{1}{2}$  of an Ounce reduced into the Fraction of a C. weight will be  $\frac{1}{2}$  of  $\frac{1}{16}$  of  $\frac{1}{4}$  of a C. weight, equal to  $\frac{1}{128}$  C. and so of any other.

An Expression of the following Form, viz.  $\frac{6 \times 20 \times 5}{40 \times 15 \times 9}$ , which implies the continued Multiplication of 6, 20, and 5, divided by the continual Product of 40, 15, and 9, may be abbreviated, by dividing any of the Factors, or Parts of the Numerator and Denominator by some Number that is a common Measure of those Parts: Thus, because 20 will measure 40 (a Part of the Numerator) and 40 (a Part of the Denominator) the Fraction will be reduced to  $\frac{6 \times 1 \times 5}{2 \times 15 \times 9}$ ; likewise, because 3 will measure 6, and 9,

it will be  $\frac{2 \times 1 \times 5}{2 \times 15 \times 3}$ ; and since 2 is a Factor both in the Nu-

merator and Denominator, it will be farther reduced to  $\frac{1 \times 5}{15 \times 3}$ ;

also because 5 will measure both 5 and 15, it will become  $\frac{1 \times 1}{3 \times 3}$ , or  $\frac{1}{9}$ , the Fraction in its lowest Terms. And after the

same Manner, may any other Fraction of the same kind be abbreviated.

IV.

## Reduction of Vulgar Fractions. 115

IV. To find the Value of any Vulgar Fraction in the known Parts of the Integer, do thus;

Multiply the Numerator of the Fraction given, by the known Parts of the next inferior Denomination; which Product divided by the Denominator, quotes the Parts of that Denomination sought; the Remainder, if any, multiplied by the Parts of the next inferior Denomination; and divided as before, gives the Parts of the next Denomination; and thus must you do, till you have it brought into the least known Parts, or till nothing remains.

# EXAMPLE

What is  $\frac{1}{4}$  of a Pound Sterling?  $\frac{1}{4}$  of 100 = 25

$\frac{133}{20}$  Numerator: 133  
 20 Shillings in a Pound  
 Denominator = 480 2660 (8 Shillings)

2400  
260 Remains  
12 Pence in a Shuang

And the next shall be for Reduc-  
be  $\frac{1}{2}$ , and  $\frac{1}{2}$  of  $\frac{1}{2}$  would be  $\frac{1}{4}$ , or  $\frac{1}{4}$ .  
So if  $\frac{1}{2}$  of  $\frac{1}{2}$  were reduced into a single fraction, it would

Denominator 480) 3120 (6 Pence

240  
4 Farthings in a Penny

$$\frac{960}{960} = 1$$

After the same Manner the Value of  $\frac{7}{8}$  of an Hundred will be 1 Quarter, 14 Pounds, and 8  $\frac{1}{8}$  Ounces.

V. To reduce whole or mixt Numbers into improper Fractions. do thus :

If your Number given be an Integer, it is but making an Unit Denominator thereunto; so 7 reduced into an improper Fraction, will be  $\frac{7}{1}$ .



## Reduction of Vulgar Fractions.

If your Denominator be fixed, the Product of it, and your Integer given, will be the Numerator.

So if 7 were to be reduced into an improper Fraction, whose Denominator should be 11, the improper Fraction answering would be  $\frac{77}{11}$ , and so in any other.

But if it be a mixt Number, then multiply the Integral Part of your mixt Number by the Denominator of your Fractional Part, and to the Product add the Numerator of the said Fractional Part, the Sum will be the Numerator to the former Denominator.

So  $2\frac{1}{2}$  will be  $\frac{5}{2}$ , and  $7\frac{1}{7}$  will be  $\frac{50}{7}$ , &c.

On the contrary, if you would reduce any improper Fraction into its equivalent whole or mixt Number, do thus:

Divide your Numerator by the Denominator, the Quotient is the whole or integral Part, and the Remainder, if any, is Numerator to the former Denominator.

So if  $\frac{11}{2}$  were reduced, it would be a whole Number, (*viz.*) 5: And if  $\frac{43}{7}$  were reduced, it would be a mixt Number, to wit,  $3\frac{3}{7}$ , and so of any other.

VI. To reduce a compound Fraction into a single Fraction.

Multiply all the Numerators one into another for a new Numerator, and the Denominators one into another for a new Denominator, so have you the single Fraction sought.

So if  $\frac{1}{2}$  of  $\frac{2}{3}$  were reduced into a single Fraction, it would be  $\frac{1}{3}$ ; and  $\frac{1}{2}$  of  $\frac{2}{3}$  of  $\frac{1}{4}$  would be  $\frac{1}{12}$ , or  $\frac{1}{4}$ .

And thus much shall suffice for Reduction.

## Addition of Vulgar Fractions.

Addition of Fractions (after they are reduced or abbreviated, if occasion be) is very easy, and consisteth only in adding together their Numerators, the Total of which is the Numerator to the given Denominator, and is the Sum of the Fractions sought. And this happens either in Fractions with Fractions, whole Numbers with Fractions, mixt with Fractions, mixt Numbers with mixt, or mixt with Integers.

I. First, Fractions with Fractions.

### EXAMPLE.

Add  $\frac{1}{2}$  to  $\frac{1}{3}$  the Sum is  $\frac{5}{6}$ , and the Sum of  $\frac{1}{12}$ ,  $\frac{1}{12}$  and  $\frac{1}{12}$  is  $\frac{1}{4}$ , or 1.

So if  $\frac{1}{2}$  and  $\frac{1}{3}$  were to be added, their Sum would be found to be  $\frac{5}{6}$ , for  $\frac{1}{2}$  and  $\frac{1}{3}$  will be reduced into  $\frac{2}{4}$  and  $\frac{1}{3}$ , and then by Addition will be  $\frac{5}{12}$ .

And

## Addition in Vulgar FRACTIONS. 117

And if  $\frac{1}{4}$  of a Pound were to be added to  $\frac{1}{2}$  of a Shilling, the Sum will be found to be  $\frac{17}{40}$ .

First  $\frac{1}{4}$  of a Shilling, reduced into the Fraction of a Pound, will be  $\frac{1}{160}$ . Secondly,  $\frac{1}{2}$  and  $\frac{1}{160}$  will be reduced into  $\frac{80}{160}$  and  $\frac{1}{160}$ ; and by Addition, Thirdly, the Sum is  $\frac{81}{160}$ ; and, Fourthly, by Abbreviation, into  $\frac{17}{40}$ .

### II. In whole Numbers with Fractions.

#### EXAMPLES.

Add 7 and  $\frac{3}{4}$  together, the Sum will be  $7\frac{3}{4}$ .

So if 5, 17,  $\frac{1}{2}$  and  $\frac{1}{4}$  of  $\frac{1}{2}$  were to be added; the Sum would be  $22\frac{3}{4}$ .

First,  $\frac{1}{4}$  of  $\frac{1}{2}$  will be reduced into this single Fraction  $\frac{1}{8}$ .

Secondly, by Reduction  $\frac{1}{2}$  and  $\frac{1}{8}$  will become  $\frac{5}{8}$  and  $\frac{1}{8}$ .

Thirdly, by Addition the Sum of those two is  $\frac{6}{8}$ .

Fourthly, by Addition 5 and 17 makes 22.

Lastly, 22 added to  $\frac{6}{8}$  is  $22\frac{3}{4}$ .

And 11 l. and  $\frac{1}{2}$  of a Shilling added together, is  $11\frac{1}{2}$ .

### III. In mixt Numbers with Integers.

#### EXAMPLES.

Add 7 and  $5\frac{1}{2}$  together, the Sum is  $12\frac{1}{2}$ , or  $12\frac{1}{2}$ .

So if 3, 9,  $2\frac{1}{4}$ , and  $5\frac{3}{4}$  were added; the Sum will be  $19\frac{3}{4}$ .

For  $2\frac{1}{4}$ , and  $5\frac{3}{4}$  will become  $\frac{5}{4}$  and  $\frac{13}{4}$  and these two again will become  $\frac{18}{4}$  and  $\frac{13}{4}$ ; and these added to the Sum of 3 and 9, (viz.) 12, become  $12\frac{31}{4}$ , or  $19\frac{3}{4}$ .

### IV. In mixt Numbers with mixt.

#### EXAMPLES.

Add  $2\frac{1}{2}$  to  $7\frac{3}{4}$ , the Sum will be  $9\frac{5}{4}$ ; for  $2\frac{1}{2}$  and  $7\frac{3}{4}$  will be reduced to  $\frac{5}{4}$  and  $\frac{13}{4}$ , and by Addition into  $\frac{18}{4}$ .

And if  $5\frac{1}{2}$  were to be added to  $4\frac{3}{4}$ , the Sum will be  $10\frac{5}{4}$ ; these being of like Bases, are very easy, being performed without any Reduction, by Addition only.

### V. Fifthly and lastly, in mixt Numbers and Fractions.

#### EXAMPLES.

Add  $\frac{1}{2}$  and  $7\frac{1}{2}$  into one Sum, *Facit* 8, for  $\frac{1}{2}$ , and  $\frac{1}{2}$  is 1, or 1, and 7 and 1 is 8.

So the Sum of  $2\frac{1}{2}$ ,  $13\frac{1}{4}$ ,  $\frac{1}{2}$  and  $\frac{3}{4}$ , will be  $17\frac{3}{4}$ , which will be equal to 17  $\frac{3}{4}$ .

And thus of any other.

Q

As

## 118 Subtraction in Vulgar Fractions.

As in *Addition* we took the Sum of Numerators, after the Work of *Reduction* (if any) was performed; so in *Subtraction* (after such Work if need be) we must take the Difference of the Numerators, observing all the Cases as in *Addition*. Of which in their Order.

I. *First*, Where both are Fractions.

### EXAMPLES.

So if the Difference of  $\frac{2}{3}$  and  $\frac{1}{2}$  were required, it would, by Subtracting the less Numerator from the greater, be found to be  $\frac{1}{6}$ .

Again, If the Difference betwixt  $1\frac{1}{2}$  and  $\frac{1}{3}$  was sought, these two Fractions, because of unequal Bases by *Reduction*, would become  $\frac{4}{2}$  and  $\frac{1}{3}$ ; and then by subtracting the less Numerator from the greater, the Difference sought will be  $1\frac{1}{2}$ .

II. *Secondly*, Where one is an Integer, and the other a Fraction.

### EXAMPLE.

If the Difference betwixt 7 and  $\frac{1}{5}$  were sought, it would be  $6\frac{4}{5}$ , for 1 from 7, rest 6; which reduced into a Fraction whose Denominator is 5, is  $\frac{4}{5}$ ; then  $\frac{1}{5}$  from  $\frac{4}{5}$  rest  $\frac{3}{5}$ , in all  $6\frac{3}{5}$ ; and the Difference of 11 Pounds and  $\frac{1}{2}$  of a Shilling, will be  $10\frac{1}{2}$ .

III. *Thirdly*, Where one is an Integer, and the other a mixt Number.

### EXAMPLE.

From 7 let us subtract 2 and  $\frac{1}{2}$ , the Remainder will be  $4\frac{1}{2}$ . So if from 13 we subtract  $11\frac{1}{2}$ , the Remainder is  $1\frac{1}{2}$ .

IV. *Fourthly*, Where both are mixt Numbers.

### EXAMPLE.

From  $16\frac{2}{3}$  subtract  $11\frac{1}{3}$ , the Remainder is  $5\frac{1}{3}$ , or  $4\frac{2}{3}$ . And from 13 Pounds and  $\frac{1}{2}$  subtract  $8\frac{1}{2}$  Shillings, rest  $12\frac{1}{2}$  of a Pound.

V. *Fifthly* and *Lastly*, Where one is a mixt Number, and the other a Fraction.

### EXAMPLE.

From  $7\frac{2}{3}$  subtract  $\frac{1}{3}$ , the Remainder will be  $6\frac{1}{3}$ .

From  $16\frac{2}{3}$  subtract  $\frac{1}{3}$ , the Remainder is  $16\frac{1}{3}$ , by taking the  $\frac{2}{3}$  from  $\frac{1}{3}$ , and the Remainder is  $16\frac{1}{3}$ .

Here it may be observed, That if one cannot distinguish the greater of two Fractions, by reducing them both into equal Bases, the greater or lesser is easily known.

In



## Multiplication in Vulgar FRACTIONS. 119

In Multiplication of Vulgar Fractions, reduce mixt Numbers into improper Fractions; whole Numbers, like Fractions, and compound Fractions into single, abbreviating where occasion is; then the Rule is, Multiply the Numerators together for a new Numerator, and the Denominators together for a new Denominator, which Numerator and Denominator is the Product sought.

### EXAMPLES.

I. Let us multiply  $1\frac{2}{3}$  by  $\frac{3}{5}$ . the Product will be  $1\frac{2}{5}$ , for 2 times 4 is 8, and 9 times 13 is 117, which placed Fractionalwise is the Product sought.

As if it were required to multiply 2 s. 6 d. by 2 s. 6 d. as the Fraction of a Pound, 2 s. 6 d. being  $\frac{1}{5}$  of a Pound; multiply  $\frac{1}{5}$  by  $\frac{1}{5}$ , Facit  $\frac{1}{25}$  of a Pound equal to 0 l. 0 s. 3 d. 3 q. By which it is evident, that Multiplication of Fractions decreases the Value in the same Proportion as whole Numbers increase it, as is intimated further in Multiplication of Decimals.

So  $\frac{1}{2}$  multiplied by  $\frac{1}{2}$  becomes  $\frac{1}{4}$ . See this demonstrated in Mr. Leyburn's *Curfus Mathematicus*, Page 38.

II. If one be an Integer and the other a Fraction, as if we would multiply  $\frac{3}{4}$  by 7, the Product will be  $2\frac{3}{4}$ , for 7 made like a Fraction is  $\frac{7}{1}$ ; then as before.

So if  $\frac{1}{18}$  were to be multiplied by 12, the Product would be  $\frac{1}{3}$ , or  $3\frac{1}{3}$ ; for  $\frac{1}{18}$  and  $\frac{12}{1}$ , may, by abbreviating the cross Terms 12 and 18, be brought into  $\frac{1}{3}$  and  $\frac{1}{1}$ ; and by Multiplication, into  $\frac{1}{3}$ , or  $3\frac{1}{3}$ .

III. If both be mixt Numbers, as if  $2\frac{3}{4}$  must be multiplied by  $5\frac{1}{2}$ , the Product would be  $14\frac{1}{2}$ , or  $14\frac{1}{2}$ .

So if 21 l. 16 s. and 9 d. were to be multiplied by 3 l. 12 s. 6 d. the Product would be  $\frac{10080}{1000}$  equal to 79 l.  $\frac{1008}{1000}$ ; for first 21 l. 16 s. 9 d. would be made 21  $\frac{67}{80}$ , and 3 l. 12 s. 6 d. would be  $3\frac{3}{8}$ , and those two again would become  $\frac{1237}{80}$  and  $\frac{27}{8}$ , and then by Multiplication would be  $\frac{10080}{640}$  l. or 79 l.  $\frac{1008}{640}$ .

IV. If you would take the Parts of any Fraction or mixt Number, it is easily done by Multiplication: Thus if you would take  $\frac{1}{3}$  of  $\frac{3}{4}$ , the same would be  $\frac{1}{4}$ ; for  $\frac{1}{3}$  multiplied by  $\frac{3}{4}$  produceth  $\frac{1}{4}$ , or  $\frac{1}{4}$ , the Part sought: So  $\frac{1}{3}$  of  $15\frac{1}{2}$  will be  $13\frac{1}{2}$ , which is nothing but the Product of one by the other.

## Division in Vulgar FRACTIONS.

In Division of Vulgar Fractions, as in Multiplication, we must reduce mixt Numbers into improper Fractions; whole Numbers like Fractions, and compound Fractions into single, abbreviating where may be needful; and then the Rule will be to multiply the Denominator of the Divisor by the Numerator of the Dividend, for the Numerator of the Quotient, and the Numerator of the Divisor by the Denominator of the Dividend, for the Denominator of

Q 2

the

18<sup>th</sup>

whole

## 120 Division in Vulgar FRACTIONS.

the Quotient, and your Work is finished; or invert the Divisor, then work as in Multiplication.

### EXAMPLES.

I. Let it be required to divide  $\frac{117}{11}$  by  $\frac{1}{11}$ , the Quotient will be found to be  $\frac{117}{1}$ ; for 13 times 8 is 104, for a Numerator, and 4 times 117 is 468, for a Denominator; which Fraction abbreviated by 4, becomes  $\frac{117}{11}$ , and that again by 13, becomes  $\frac{9}{1}$ , as in the Work.

*The Work.*

$$\begin{array}{r} 13 \overline{) 117} \\ 11 \phantom{0} \\ \hline 6 \phantom{0} \\ 53 \phantom{0} \\ 468 \phantom{0} \\ \hline 0 \end{array}$$

Divide  $\frac{11}{11}$  by  $\frac{1}{11}$ , the Quotient will be  $\frac{11}{1}$  equal to 1 Integer, by which it doth appear the Fractions were equal one to the other, and had been the same as if I had divided  $\frac{1}{11}$  by  $\frac{1}{11}$ ; for any Fraction divided by itself, quotes Unity.

$$\begin{array}{r} 11 \overline{) 11} \\ 11 \\ \hline 0 \end{array}$$

II. If one be an Integer and the other a Fraction, as if we would divide  $\frac{2}{3}$  by 7, the Quotient would be  $\frac{2}{21}$ .

But if you must divide 7 by  $\frac{2}{3}$ , the Quotient will be  $10\frac{1}{2}$ , or  $17\frac{1}{2}$ .

$$\begin{array}{r} 7 \overline{) \frac{2}{3}} \\ 2 \\ \hline 1 \end{array}$$

$$\begin{array}{r} 17 \overline{) 1} \\ 17 \\ \hline 0 \end{array}$$

III. If both be mixt Numbers, or one a Fraction and the other a mixt Number, as if  $5\frac{1}{2}$  must be divided by  $2\frac{1}{2}$ , the Quotient would be  $\frac{11}{5}$ , or  $2\frac{1}{5}$ ; for  $2\frac{1}{2}$  would by Reduction become  $\frac{5}{2}$ , and  $5\frac{1}{2}$  would be  $\frac{11}{2}$ , which would quote  $\frac{11}{5}$ , or  $2\frac{1}{5}$ .

*See the Work.*

$$\begin{array}{r} 11 \overline{) \frac{11}{2}} \\ 10 \\ \hline 1 \end{array}$$

Divide  $\frac{3}{4}$  by  $5\frac{1}{2}$ , the Quotient would be  $\frac{3}{28}$ .

You may note, If a Fraction be divided by a whole Number, the Denominator multiplied by that Number, the Product is the new Denominator, and the Numerator the same as before.

### The Rule of three in Vulgar FRACTIONS.

In the Rule of Three, or Golden Rule in Vulgar Fractions, if any of your Terms be Integers, mixt or compound Fractions, they must be reduced, as hath been before shewn; then stating your Question, as shewn in the Golden Rule foregoing, and multiplying and dividing, as in Multiplication and Division of Vulgar Fractions, your Work is finished, and the Quotient gives your Answer.

### EXAMPLE.

If  $\frac{2}{3}$  of a Yard cost  $\frac{1}{2}$  of a Pound, what will  $\frac{1}{4}$  of a Yard cost?

*Thus stated.*

$$\begin{array}{r} Yd. \quad L. \quad Yd. \quad \frac{1}{4} \quad \frac{1}{2} \\ \text{If } \frac{2}{3} : \frac{1}{2} :: \frac{1}{4} : x \\ \frac{2}{3} \quad 15 \overline{) 15} \quad \frac{1}{2} \quad 15 \overline{) 15} \end{array}$$

$\frac{1}{4}$  is  $\frac{1}{2}$  equal to 12 s. 1 d. 2 q. 17.

II.

## Rule of Three in Vulgar FRACTIONS. 121

II. If  $\frac{1}{4}$  of a Yard of Velvet cost 7 Shillings and 3 Pence, what will 9 Yards and  $\frac{1}{4}$  cost?

Your Numbers reduced and stated as afore taught, appear as in the Work.

Yd. l. Yd.

If  $\frac{1}{4} : \frac{87}{4} :: \frac{28}{1}$

Contracted thus; If  $\frac{1}{4} : \frac{28}{1} :: \frac{87}{4}$ . *Facit*  $\frac{203}{4} l. = 4 l. 10 s. 2 d. 2 q. \frac{2}{3}$

In this Question, seeing the Numerators of the two last Terms, and their altern Denominators, may be severally abbreviated; one, (*viz.*) the Number of the last Term, and the Denominator of the 2d by 4, and the Number of the 2d Term and Denominator of the last, by 3; the contracted Terms of which are  $\frac{28}{3}$  for the second Term, and  $\frac{87}{4}$  for the third or last Term, then the Work will stand thus; If  $\frac{1}{4} : \frac{28}{3} :: \frac{87}{4}$ . And seeing again the Denominator of the last Term is an Unit, and the Denominator of the two first Terms may be abbreviated by 4, after which the 3 Terms offer themselves thus; If  $\frac{1}{4} : \frac{28}{3} :: \frac{87}{4}$ . And the 4th Term is easily found by multiplying the Numerator of the Quotient; and the Numerator of the 1st Term by the Denominator of the 2d, for the Denominator of the said Quotient; so the 4th Term sought will be  $\frac{203}{4}$ , equal to 4l.  $\frac{23}{4}$ , or 4l. 10 s. 2 d. 2 q.  $\frac{2}{3}$ , as in the Work.

III. If  $\frac{1}{4}$  of a Pound of Flax cost 8 Pence, what will 1 Pound cost? *Facit* 10 d.  $\frac{2}{3}$ .

*The Work.*

lb. d.

If  $\frac{1}{4} : \frac{8}{1} :: \frac{1}{1}$

$\frac{1}{4}) \frac{8}{1} (\frac{32}{4} = 10 d. \frac{2}{3}$ .

If either of the Extreams be a Fraction and the other not, as here, reduce it to a like Denomination, cancel the Denominators, and work as in Integers. So if 3 q. : 8 d. :: 4 q. *Facit* 10 d.  $\frac{2}{3}$  as before.

IV. If 3 Men do a piece of Work in 4  $\frac{1}{2}$  Hours, in how many Hours shall 10 Men do the same Work? *Facit* 1 Hour 21 Min.

*The Work.*

M. H. M.

If  $\frac{3}{1} : \frac{9}{2} :: \frac{10}{1}$

$\frac{10}{1}) \frac{27}{2} (\frac{27}{2} \text{ equal to } 1 \text{ Hour and } \frac{7}{2}$ .

V. If the Penny white Loaf weigh 7 Ounces, when a Bushel of Wheat cost 5 s. 6 d. what is the Bushel worth, when the Penny white Loaf weighs but 2 Ounces and  $\frac{1}{2}$ . *Ans.* 15 s.  $\frac{2}{3}$ .

l. s. l.

Say if  $\frac{7}{2} : \frac{11}{2} :: \frac{5}{1}$

$\frac{5}{1}) \frac{77}{2} (\frac{77}{2} = 15 s. \frac{2}{3} \text{ the Answer.}$

Seeing



## 122 Rule of Three in Vulgar FRACTIONS.

Seeing the Denominators of the dividend and Divisor are both the same, throw them away, the Numerator of the Dividend is the Numerator of the Quotient, and the Numerator of the Divisor, Denominator thereto.

### Double Rule of Three in Vulgar FRACTIONS.

Take a Question or two in *Double Golden Rule in Vulgar Fractions*, and so finish *Vulgar Fractions*.

Question I. If 13 l. 6 s. 8 d. in  $\frac{1}{2}$  of a Year gain 1 l.  $\frac{1}{12}$ , what will 50 l. gain in 5 Months?

First I say, If  $\frac{40}{3} : \frac{13}{2} :: \frac{50}{1}$ . Facit 4 l. 1 s. 3 d.

$\frac{40}{3} \times \frac{50}{1} = \frac{2000}{3}$   $\frac{13}{2} \times \frac{1}{12} = \frac{13}{24}$   $\frac{2000}{3} \div \frac{13}{24} = 4 \frac{1}{6}$

Say again, If  $\frac{3}{4} : \frac{65}{16} :: \frac{1}{12}$ . Facit 2 l. 5 s. 1 d. 2 q.  $\frac{3}{4}$ .

Question II. If 50 Pounds in 5 Months gain 2 l. 5 s. 1 d. 2 q.  $\frac{3}{4}$ , or 2 l.  $\frac{37}{44}$ , what time will 13 l. 6 s. 8 d. or 13 l.  $\frac{1}{3}$  require to gain 1 l. 1 s. 3 d. or 1 l.  $\frac{1}{12}$ ?

First say, If  $\frac{50}{1} : \frac{1}{12} :: \frac{40}{3}$ . Facit  $\frac{25}{3}$ , or 1 Year and  $\frac{2}{3}$ .

Say again, If  $\frac{25}{3} : \frac{2}{3} :: \frac{1}{12}$ . Facit  $\frac{1}{15}$ , or  $\frac{1}{4}$  of a Year, or 9 Months.

Note, The former Proportion was Inverse, and the 2d was Direct. This shall suffice for the *Golden Rule in Fractions*.

### Questions to exercise Vulgar FRACTIONS.

Question I. The Difference of two Numbers is  $21 \frac{7}{8}$ , the lesser  $17 \frac{1}{4}$ , what is the greater? Answer  $39 \frac{137}{8}$ , found by Addition.

Question II. There is in 3 Bags 56 lb.  $\frac{3}{4}$ ; in the first Bag 12 Pounds and  $\frac{1}{8}$ ; in the 2d,  $21 \frac{1}{2}$ , what is in the 3d Bag? Answer  $22 \frac{47}{8}$ , found by Addition and Subtraction.

Question III. What Number added to  $11 \frac{1}{7}$  will produce  $36 \frac{337}{16}$ ? Answer  $24 \frac{71}{7}$ , found by Subtraction.

Question IV. What is  $\frac{7}{11}$  of  $\frac{1}{37}$ ? Answer  $\frac{133}{407}$ , found by Multiplication.

Question V. What Number multiplied by  $\frac{3}{7}$  produceth  $11 \frac{1}{7}$ ? Answer  $26 \frac{46}{7}$ , found by Division.

## ARITHMETICAL PROGRESSION.

**PROGRESSION** consisteth of two Parts, *Arithmetical* and *Geometrical*.

*Arithmetical Progression* is, when a Rank of Numbers above two, increase or decrease equally, by the continual Addition or Subtraction of some equal Number.

So 1, 3, 5, 7, 9, 11, and 42, 35, 28, 21, 14, 7, are two Ranks of Numbers in *Arithmetical Progression*; the first increasing by the continual Addition of Two, and the second decreasing by the continual Subtraction of Seven; and so of any other.

In *Arithmetical Progression* these five Things are to be consider'd:

- (1.) The first Term commonly the least Term.
- (2.) The last Term commonly the greatest.
- (3.) The Number of Terms.
- (4.) The equal Difference, or common Excess.
- (5.) The Sum of all the Terms, or total Aggregate.

Any Three of these Five being given, the other Two may be found, which will admit of 20 Propositions, as may be seen in Mr. *Oughtred's Clavis Mathematica*, Chap. 29. Prob. 4. either in the *Latin*, or late *English* Translation: But we shall not concern ourselves with them all, but only such as may be of common Use.

But in the first place we will lay down some *Theorems*, for the better understanding of what follows after.

### THEOREM I.

Any Term of an *Arithmetical Progression* contains the first (that is the least) Term, together with the Product of the common Excess and Number of Terms before it.

So in this *Arithmetical Progression*, 2, 5, 8, 11, 14, 17, the Term 17 is equal to the first Term Two, added to the

the Product of 5, the preceding Number of Terms by 3, the common Excess.

Hence may arise this *Corollary*.

That if the common Excess be multiplied by the Number of Terms *minus Unity*, and to the Product the least Term be added, the Sum is equal to the greatest.

### THEOREM II.

If Three Numbers be in *Arithmetical Progression*, the Double of the Mean is equal to the Sum of the Extreams.

So 2, 4, 6, are Three Numbers in *Arithmetical Progression*, and the Double of the Mean 4, is equal to the Sum of the two Extreams 2 and 6.

### THEOREM III.

If Four Numbers are in *Arithmetical Progression*, the Sums of the two Means is equal to the Sum of the two Extreams.

So 7, 11, 15, 19, are Four Numbers in *Arithmetical Progression*, and the Sum of the two Means, 11 and 15, is equal to the Sum of the two Extreams 7 and 19.

### THEOREM IV.

In an *Arithmetical Progression*, any Term doubled is equal to the Sum of any other two Terms equally distant.

### EXAMPLE.

3, 8, 13, 18, (23) 28, 33, 38, 43.

In the annexed *Arithmetical Progression*, the double of 23 is equal to the Sum of 3 and 43, or of 8 and 38, or of 13 and 33, or of 18 and 28, all Numbers which are equally distant.

### THEOREM V.

In any *Arithmetical Progression*, the Sum of any two Terms is equal to the Sum of any other two Terms of like Distance from them.

### EXAMPLE.

2, 5, 8, 11, 14, 17, 20, 23, 26, 29.

In the annexed *Progression*, the Sum of 14 and 23, is equal to the Sum of 8 and 29, or of 11 and 26, or of 17 and 20; all being alike distant.

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THEOREM VI.

1. In any *Arithmetical Progression* whatsoever, if the Sum of the greatest and least Terms be multiplied by the Numbers of Terms, and the Product divided by 2, the Quotient is equal to the Sum of all the Terms.

2. Or if the Sum of the greatest and least be multiplied by  $\frac{1}{2}$  the Number of Terms, the Product is equal to the Sum of all the Terms.

3. Or if the half Sum of the greatest and least Terms be multiplied by the Number of Terms, the Product is equal to the Sum of all the Terms.

4. Or the middle Number (when the Progression is odd) multiplied by the Number of Terms, gives the Sum of all the Terms.

EXAMPLE.

3, 6, 9, 12, 15, 18, 21.

| (1.)                  | (2.)       | (3.)                  | (4.)     |
|-----------------------|------------|-----------------------|----------|
| 21                    | 21         | 12 $\frac{1}{2}$ Sum. | 12       |
| <u>3</u>              | <u>3</u>   | <u>7</u>              | <u>7</u> |
| 24                    | 24         | 84 Sum.               | 84 Sum.  |
| <u>7</u>              | <u>3.5</u> |                       |          |
| 168                   | 120        |                       |          |
| $\frac{1}{2}$ 84 Sum. | 72         |                       |          |

Every way the same.

840 Sum.

THEOREM VII.

In a Progression of Natural Numbers, as 1, 2, 3, 4, &c. if the last Term be multiplied by the next greater, one half of the Product is equal to the Sum of the whole Progression.

1, 2, 3, 4, 5, 6, 7.

So the Product of 7 by the next greater 8, gives 56; one half of which is 28, which is the Sum of the whole Progression.

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## THEOREM VIII.

In a *Natural Progression* of odd Numbers, as 1, 3, 5, 7, &c. the Sum of the whole is equal to the Square of the Number of Terms.

1, 3, 5, 7, 9, 11, 13.

The Number of Terms 7 squared is 49, the Sum of the whole.

## THEOREM IX.

In a *Natural Progression* of even Numbers, the Sum of the whole is equal to the Product of the Number of Terms by the Number of Terms *Plus Unity*.

2, 4, 6, 8, 10, 12.

Here the Number of Terms is 6, which multiplied by 7, gives 42, equal the Sum of the whole.

## THEOREM X.

In any *Arithmetical Progression* whatsoever, if from the greatest Term the least be taken, the Remainder divided by the common Excess, and to the Quotient adding *Unity*, you have the Number of Terms.

2, 4, 6, 8, 10, 12, 14.

From 14 subtracting 2, rest 12, divided by the common Excess 2, gives 6, to which add *Unity*, makes 7, equal to the Number of Terms.

## THEOREM XI.

In any *Arithmetical Progression* whatsoever, if from the last Term the first Term be subtracted, and the Remainder divided by the Number of Terms *Minus Unity*, the Quotient is the common Excess.

3, 5, 7, 9, 11, 13.

From 13 subtracting 3, rest 10, which divided by 5, one less than the Number of Terms, quotes 2, the common Excess.

Let these *Theorems* suffice; we will now return to where we left, in having any three of the five given, to find the other two.

PROP.

# Arithmetical Progression. 127

## P R O P. I.

The first or least Term, the last or greatest Term, and the Number of Terms being given, to find the common Excess.

Or, the first, second and third given, to find the fourth.

## R U L E.

From the second subtract the first, the Remainder, divided by the third Minus Unity, quotes the fourth.

By Theorem the first, and the Corollary.

## E X A M P L E.

A Man had 12 Sons, the youngest was 3 Years old, and the elder was 58, they increased in *Arithmetical Progression*; what was the common Difference of their Ages?

The 2d 58

The 1st 3

The 3d  $58 - 3 = 55$  (5)  
 $55 \div 11 = 5$

o

*Answer,* They increase by five Years.

## P R O P. II.

The First, Second, and Third given, to find the Fifth.

## R U L E.

Multiply the half Sum of the first and second by the third, the Product is the fifth.

By Theorem the 6th, and third Way.

## E X A M P L E.

A Man buys 17 Yards of Kersey in *Arithmetical Progression*; for the first Yard he paid two Shillings, or 24 Pence, and for the last Yard ten Shillings, or 120 Pence; what did the whole amount to?

R 2

The



## 128. *Arithmetical PROGRESSION.*

The first Term                      24  
The last Term                      120

Sum = 144

$\frac{1}{2}$  Sum 72

Multiply by the Num. of Terms 17

594

72

1224 the Answer in Pence.

$\frac{1}{12}$  1012

Ans. 5l. 2s.

### PROP. III.

The First, Second, and Fourth given, to find out the Third.

### RULE.

From the second subtract the first, the Remainder divided by the fourth, the Quotient *plus Unity*, is equal to the third : By *Theorem the first* and the *Corollary*.

### EXAMPLE.

A Man going a Journey, his first Day's Travel was five Miles, his last Day's Travel was 35 Miles, he increased his Journey every Day three Miles; how many Days did he travel? *Ans.* He travell'd 11 Days.

The last                      35  
The first                      5

3) 30 (10 + 1 = 11

30

00

PROP.

# Arithmetical PROGRESSION. 126

## PROP. IV.

The Second, Third and Fourth given, to find the First.

### RULE.

Multiply the fourth by the third *Minus Unity*, the Product subtracted from the second leaves the first.

### EXAMPLE.

A Man in 6 Days went to London from Manchester, every Day's Journey was greater than the Day before by four Miles, his last Day's Journey was 40 Miles; what was the first? *Answ.* 20 Miles.

The 4th is 4

The 3d — 1 is 5

The Product 20, which subtract from the second 40, leaves 20, the first Day's Journey.

40

20

20 the Answer.

## PROP. V.

The First, Third and fourth given, to find out the Fifth.

### RULE.

From the Product of the third into the fourth, subtract the fourth, and to the Remainder add the Double of the first,  $\frac{1}{2}$  the Product of that Sum multiplied by the third, gives the fifth.

### EXAMPLE.

An hundred Eggs are placed in a right Line a Yard distant one from another, and the first a Yard distant from a Basket: It is required to know how far one must go before he brings the Eggs one by one into the Basket without breaking any?

1

The

# 128. *Arithmetical PROGRESSION.*

The first Term 24  
The last Term 120

Sum = 144

Sum 72

Multiply by the Num. of Terms 17

594

72

1224 the Answer in Pence.

10 1/2

Ans. 5 l. 2 s.

## PROP. III.

The First, Second, and Fourth given, to find out the Third.

## RULE.

From the second subtract the first, the Remainder divided by the fourth, the Quotient *plus Unity*, is equal to the third : By *Theorem the first* and the *Corollary*.

## EXAMPLE.

A Man going a Journey, his first Day's Travel was five Miles, his last Day's Travel was 35 Miles, he increased his Journey every Day three Miles; how many Days did he travel? *Ans.* He travell'd 11 Days.

The last 35  
The first 5

3) 30 (10 + 1 = 11

30

## PROP.



# Arithmetical PROGRESSION. 126

## PROP. IV.

The Second, Third and Fourth given, to find the First.

## RULE.

Multiply the fourth by the third Minus Unity, the Product subtracted from the second leaves the first.

## EXAMPLE.

A Man in 6 Days went to London from Manchester, every Day's Journey was greater than the Day before by four Miles, his last Day's Journey was 40 Miles; what was the first? *Ans.* 20 Miles.

The 4th is 40

The 3d — 1 is 39

The Product 1560, which subtract from the second 40, leaves 20, the first Day's Journey.

40

20

20 the Answer.

## PROP. V.

The First, Third and fourth given, to find out the Fifth.

## RULE.

From the Product of the third into the fourth, subtract the fourth, and to the Remainder add the Double of the first,  $\frac{1}{2}$  the Product of that Sum multiplied by the third, gives the fifth.

## EXAMPLE.

An hundred Eggs are placed in a right Line a Yard distant one from another, and the first a Yard distant from a Basket: It is required to know how far one must go before he brings the Eggs one by one into the Basket without breaking any?

The

# 130 Arithmetical PROGRESSION.

The Third 100 Sir Jonas Moore makes the  
 The fourth 2 Distance run but 10000  
 Yards, which is 2000 little  
 by 100 Yards. Moore's  
 The fourth 2 Arith. p. 324. Last Edi-  
 tion.

Rest 108  
 The Doub. of the 1st \* 2  
 Multip. by the 3d = 20200  
 10100

Ans. 10100 Yards, or 5 Miles and  $\frac{1}{2}$  wanting 20 Yards.

## P R O P. VI.

The Third, Fourth and Fifth given, to find the First.

## R U L E.

Divide the fifth by the Third, and from the Quotient subtract  $\frac{1}{2}$  the Product of the Fourth into the Third Minus Unity: The Remainder is the first.

## E X A M P L E.

A Man is to receive 300 Pounds at 12 several Payments, each Payment to exceed the former by four Pounds; he is willing to bestow the first Payment on any one that can tell him what it is.

What must the Arithmetician have for his Pains?

$$\begin{array}{r} 12) 300 \quad (25 \\ \underline{24} \quad 22 \\ 60 \quad 3 \\ \underline{60} \\ 00 \end{array} \qquad \begin{array}{r} 11 \\ 4 \\ 44 \\ \underline{122} \end{array}$$

Ans. Three Pounds are the Workman's Wages.

Many more Propositions might have been added, but the foregoing are sufficient in most Cases; wherefore we will begin with Geometrical Progression.

Geo-

## GEOMETRICAL PROGRESSION.

**G**eometrical Progression is, when a Rank of Numbers above two increase or decrease by an equal *Ratio*; that is, by the continual Multiplication or Division of some equal Number.

So 2, 4, 8, 16, 32, 64, and 1215, 405, 135, 45, 15, 5, are two Ranks of Numbers in Geometrical Progression, the first ascending and increasing, by continually multiplying the foregoing Term or Number by 2, or by a double *Ratio*.

And the second descending or decreasing, by continually dividing the preceding Term by 3, or in a triple *Ratio*.

In any Geometrical Progression, the same Things are to be considered as in Arithmetical Progression: As first, the first Term commonly the least. Secondly, the last Term commonly the greatest. Thirdly, the Number of Terms. Fourthly, the *Ratio* or common Excess. Fifthly, the Total Sum of all the Terms.

But before we mention any Propositions, we will annex some Theorems, as preparatory thereunto.

### THEOREM I.

If three Numbers be in Geometrical Progression, the Square of the Mean, or Middle Number is equal to the Product of the two Extrems.

#### EXAMPLE.

3, 9, 27, are three Numbers in Geometrical Progression, and the Square of 9, the Mean, is equal to the Product of 27 by 3, the two Extrems; and so in others.

### THEOREM II.

If four Numbers be in Geometrical Progression, the Product or *Rectangle* of the two Means, is equal to the Product of the two Extrems.

#### EXAMPLE.

3, 15, 75, 375, are four Numbers in Geometrical Progression, and the Product of the two Means (*viz.*) of 75 by 15, is equal to the Product of 375 by 3.

This



This will likewise hold, if the four Numbers be discontinued, as in these four Numbers following, 6, 12 :: 18, 36; for the Product of 36 by 6, is equal to the Product of 18 by 12. And hence proceeds that excellent Rule in Arithmetick, called *The Rule of Proportion, Rule of Three; or, Golden Rule.*

### THEOREM III.

If any Term of Geometrical Progression be squared, it will be equal to the Product of any other two Terms of like Distance from that Term either way.

#### EXAMPLE.

3, 6, 12, 24, (48,) 96, 192, 384, 768.

In the annexed Geometrical Progression, the Square of 48 is equal to the Product of 768, by 3, or of 384 by 6, or of 192 by 12, or of 96 by 24; all being Terms equally distant.

### THEOREM IV.

In any Geometrical Progression whatsoever, the Product of the two Extrems is equal to the Product of any other two immediate Terms of like Distance from both.

#### EXAMPLE.

5, 20, 80, 320, 1280, 5120.

So in this Geometrical Progression, the Product of the two Extrems 5120 by 5, is equal to the Product of 1280 by 20, or of 320 by 80, all being a like Distance from both.

### THEOREM V.

Any Geometrical Progression may be continued *ad Infinitum* upwards, and ascending by Multiplication, and downward, or descending by Division, the Ratio or common Excess being given, that being your Multiplier upwards, and your Divisor downwards; notwithstanding oftentimes, the Terms will not continue integral Numbers, neither in the ascending or descending Part thereof, as hereafter declared.

#### EXAMPLE.

Or.  $\frac{13}{3}$ ,  $\frac{14}{3}$ , 8, 12, 18, 27,  $\frac{21}{2}$ ,  $\frac{22}{2}$ , &c.

So in the annexed Progression, if 8, 12, 18, were to be continued infinitely forward and backward, the common Exce

## Geometrical PROGRESSION.

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Excess being  $1\frac{1}{2}$  or  $\frac{3}{2}$ , suppose forwards; first, I multiply 18 by  $\frac{3}{2}$ , gives 27 for the next Term, and 27 multiplied by  $\frac{3}{2}$  gives  $40\frac{1}{2}$  for the next Term; and here the Integral Parts or Terms cease, and multiplying  $40\frac{1}{2}$  by  $\frac{3}{2}$  gives  $60\frac{3}{4}$ , and so as far as you please: Then in the descending Part, if I divide 8 by  $\frac{3}{2}$ , the Quotient is  $5\frac{1}{3}$  for the next descending Term, and that by  $\frac{3}{2}$  gives  $3\frac{2}{3}$ , and so on as far as you please.

### THEOREM VI.

Any Geometrical Progression, where the *Ratio* is *Multiple* (that is, where the greater Term is exactly measured by the less) may be continued upwards *ad Infinitum* in integral Numbers, but downwards sometimes not so far as Unity.

#### EXAMPLE I.

1, 2, 4, 8, 16, 32, 64, &c.

In the annexed Progression, the *Ratio* or common Excess being Two, by which multiplying any Term, as 8 gives 16, and that by 2 produceth 32, and that by 2 gives 64, and so *ad Infinitum* in Integral Numbers; and in descending, it will come down as far as Unity; for 8 divided by 2 quotes 4, and that by 2 gives 2, and 2 by 2 gives 1, then Integers cease.

#### EXAMPLE II.

$\frac{1}{3}$ , 3, 6, 12, 24, 48, 96, &c.

But in this Progression, though the Terms may be continued upward *ad Infinitum*, as in the last, yet it will not descend so far as Unity without a Fraction, because 3 cannot be divided by the *Ratio*, which is 2, without a Remainder.

### THEOREM VII.

In any Geometrical Progression, if the *Ratio* be not *Multiple*, the same can neither be continued upwards *ad Infinitum* in Integral Numbers, nor downwards so far as Unity.

27, 36, 48, 64,  $81\frac{1}{3}$ .

In the annexed Progression where the *Ratio* is  $\frac{4}{3}$ , the Terms quickly become mixt Numbers, both in the ascending and descending Part thereof; for seeing 64 and 27 cannot be multiplied or divided evenly by  $\frac{4}{3}$ , the Integral Terms cease.

## THEOREM. VIII.

In any Geometrical Progression, if the Extreams be prime Numbers one to another, the same Progression can be continued no farther, either upwards or downwards in Integral Numbers; so in the last Example, supposing 27 and 64 to be the extream Terms, and they being Prime one to another, therefore they can be continued no farther either way in Integral Numbers.

## THEOREM IX.

In any Geometrical Progression proceeding from Unity, the second Term (the first Term not being computed) the 4th, 6th, and 8th Term, and all the following Terms, whose Exponents may be divided by 2, are square Numbers: The 3d, 6th, 9th, and

*Exponents are a Series of natural Numbers proceeding from Unity, shewing the Places of the Terms of the Progression.*

all the following Terms, whose Exponents may be divided by 3, are Cube Numbers. The 6th, 12th, 18th, and the following Terms, whose Exponents may be divided by 6, are both

Square and Cube Numbers. The 5th, 7th, 11th, 13th, and all the following Terms, whose Exponents are prime Numbers, are neither Square nor Cube Numbers.

## EXAMPLE.

Numbers are said to be Prime, which Unity only measureth.

0 . 1 . 2 . 3 . 4 . 5 . 6 . 7 . 8  
1 . 2 . 4 . 8 . 16 . 32 . 64 . 128 . 256

This Example needs no Explication.

*Note,* That in this and some following Theorems, whether proceeding from Unity or not, it being commodious, we have annexed their Indices or Exponents, placing a Cypher over the first Term of the Progression; whereby it may be seen how far any Term is distant from Unity, or from the first Term if not Unity.

THE



THEOREM X.

In any Geometrical Progression, proceeding from Unity, if any Term be squared or multiplied by itself, it will produce any Term of the same Progression doubly distant from Unity.

EXAMPLE.

0 . 1 . 2 . 3 . 4 . 5 . 6 . 7 . 8  
1 . 2 . 4 . 8 . 16 . 32 . 64 . 128 . 256

So in this Progression the Square of 8, the 3d Term, is equal to 64, which is the 6th Term, or doubly distant from the 1st, or Unity.

THEOREM XI.

In any Geometrical Progression proceeding from Unity, the Rectangle of any two Terms is equal to that Term of the same Progression, signified by the Sum of the others Exponents.

EXAMPLE.

0 . 1 . 2 . 3 . 4 . 5 . 6 . 7  
1 . 3 . 9 . 27 . 81 . 243 . 729 . 2187

In this Progression, the Product of the 3d and 4th Terms (viz.) of 81 by 27, or of the 5th and 2d Terms (viz.) of 243 by 9, is equal to the 7th Term of the same Progression, which is 2187, because the Sum of either of their Exponents make 7.

THEOREM XII.

In any Geometrical Progression, not proceeding from Unity, if any Term be squared or multiplied by itself, and the Product divided by the first or least Term, the Quotient gives a Term doubly distant from the first.

EXAMPLE.

0 . 1 . 2 . 3 . 4 . 5 . 6 . 7 . 8  
3 . 6 . 12 . 24 . 48 . 96 . 192 . 384 . 768

In the annexed Progression, if the 4th Term (viz. 48) be squared and divided by the first Term 3, the Quote is 768, which is the 8th Term, and doubly distant from the first.

## THEOREM XIII.

In any Geometrical Progression not proceeding from Unity, if any two Terms be multiplied together, and the Product divided by the least or first Term, the Quotient will be equal to that Term signified by the Sum of the others Exponents.

## THEOREM I.

8 . 1 . 2 . 3 . 4 . 5 . 6 . 7  
2 . 6 . 18 . 54 . 162 . 486 . 1458 . 4374

In this Progression, if the 2d and the 5th be multiplied together, and the Product divided by the least Term, the Quotient will be equal to the 7th Term, because the Sum of their Exponents make 7. *Note*, These four last Theorems are useful in finding any following Term of a Geometrical Progression, without producing all the intermediate Terms.

## THEOREM XIV.

In any finite Geometrical Progression, where the Ratio is double, the Difference of the greatest and least Term is equal to the Sum of all the Terms, except the greatest.

## EXAMPLE.

3 . 6 . 12 . 24 . 48 . 96 . 192  
In this Progression, if from the greatest Term 192 we take the least Term 3, the Remainder 189 is the Sum of all, except the greatest.

## THEOREM XV.

In any finite Geometrical Progression it holds,  
As the Ratio, or common Excess, minus Unity:  
So is the Difference of the greatest and least Term:  
To the Sum of all, except the greatest.

## EXAMPLE.

3 . 9 . 27 . 81 . 243 . 729 . 2187  
So in the annex'd Progression, I say,  
As the Ratio, minus Unity (*viz.*) 2:  
Is to Unity (*viz.*) 1:  
So is 2184 the Difference of the greatest and least:  
To 1092 the Sum of all the rest.

# Geometrical PROGRESSION.

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## COROLLARY.

Hence it follows, that if the Ratio of any Geometrical Progression be double, the Difference of the greatest and least Term is equal to all the rest; if the Ratio be triple, the Excess or Difference is double the Sum of all the rest: If quadruple, triple: If quintuple, quadruple; and so on.

## THEOREM XVI.

In any finite Geometrical Progression it holds,

As the Difference of the two greatest Terms:

Is to the greatest:

So is the greatest minus the least

To the Total Sum of all, excepting the least.

## EXAMPLE.

5 . 10 . 20 . 40 . 80 . 160

In this Progression, As 80 : to 160 :: So 155 : to 310, is the Sum of all but the least.

## THEOREM XVII.

In any Geometrical Progression whatsoever, decreasing and continued *ad Infinitum*, it holds,

As the common Difference minus Unity :

Is to Unity :

So is the first or greatest Term :

To the Sum of all the following Terms, *in Infinitum*.

## EXAMPLE.

162 . 54 . 18 . 6 . 2 .  $\frac{2}{3}$  .  $\frac{2}{9}$  .  $\frac{2}{27}$  .  $\frac{2}{81}$  .  $\frac{2}{243}$  . &c.

Let the first or greatest Term of an infinite decreasing Progression be 162, and let the Ratio be triple; then will the Terms descend, as in the Example: For 162 divided by 3, gives 54; and 54 by 3, quotes 18, and so on, as in the Table; and still further, *ad Infinitum*. And it will follow,

That as 2 : (*viz.* the Ratio minus Unity) is to Unity, or 1 : : So is 162 : the greatest or first Term to 81, which is the Sum of all the remaining Terms *ad Infinitum*. This appears plain by the 15th Theorem. Wherefore in any Geometrical Progression descending in any given Pro-

portion,



portion, *ad Infinitum*, the least Term vanisheth; and therefore it holds as in this *Theorem*.

This may appear strange to many, how it should be possible to give the Sum of an infinite Progression in Numbers; whereas, if the Work were actually begun, and the Terms continued, it would after a Thousand Years Labour, and after Thousands of Millions of Terms, be never nearer finishing. And yet that the Sum of this infinite Progression should so easily be found, it appeared to me at first as a Notion (if I may so speak) almost Divine; but that it may be performed, take the following Demonstration.

Let there be several continual Proportionals, as  $ax, bx, cx, &c.$  all which transfer into the first  $ax$ ; then will  $ab, bc, ce, ef, &c.$  be proportional Differences, which together with the last Quantity  $ix$ , are equal to the first  $ax$ ; because if that Proportional Number be continued downward *ad Infinitum*, the last Quantity, as said before, vanisheth.

Therefore the infinite proportional Differences are equal to the whole Line  $ax$ ; further, because it holds, that as  $ax$  to  $bx$ , so  $bx$  to  $cx$ , and so on; and

by Division, as  $ab$  to  $bx$ , so  $bc$  to  $cx$ . And by Conversion, as  $ab$  the first Difference to  $ax$  the first Quantity; So  $bc$  the second Difference to  $bx$  the second Quantity, and so on. Therefore, as  $ab$  the first Difference to  $ax$  the first Quantity; so all the Differences to all the Quantities, that is, to the whole Sum of all the infinite Quantities, which was to be demonstrated.

Hence may arise this *Corollary*:

That the first Term of an infinite descending Geometrical Progression, where the Ratio is double, is equal to the Sum of all the rest, *ad Infinitum*.

But if the Ratio be triple, the first Term is double the Sum of all the rest; in a quadruple Progression, triple; in a quintuple one, quadruple; and so on. Hence we may demonstrate Unity not to be the beginning of Numbers.

THE

THEOREM XVIII.

In any Geometrical Progression continued downward *ad Infinitum*, It will be, As the Difference of the two first, or greatest Terms : Is to the second Term : : So is the first, or greatest Term : To the Sum of all the rest *ad Infinitum*. So in the last Example, the Difference of the two first Terms is 108, the second Term is 54, the first 162.

Wherefore, As 108 : To 54 : : So is 162 : To 81, the Sum of all the rest *ad Infinitum*.

Wherefore the Difference of the two first Terms, the first Term, and the Sum of the infinite Terms are continual Proportionals, as was demonstrated in the last. Hence may arise this *Corollary* :

That when the two first, or greatest Terms, differ only by Unity ; the Square of the first Term is equal to the Sum of all the rest, *ad Infinitum*.

Many more *Theorems* might be laid down, but these are sufficient ; we will only annex a *Proposition* or two, and so conclude both *Arithmetical* and *Geometrical Progression*.

PROP. I.

In any Geometrical Progression proceeding from Unity, the Ratio being known, how to find any remote Term without producing all the intermediate Terms.

RULE.

Find a few of the leading Terms, over which place their Exponents ; then, by *Theorem 10*. multiply the last found Term by itself, which will produce a Term double thereto. And this last multiplied by itself, produceth another Term doubly distant again : Thus do till either you have the Term sought, or one that falls a little short ; if so, multiply the Term last found by that Term answering the Difference of the Exponent of the last found Term, and that sought, this last Product is the Term required, by *Theorem 11*.

EXAMPLE.

A Country Gentleman going to a Fair to buy Oxen, meets with a crafty Youth, who had a Company of very good Oxen, in Number 23. The Gentleman demanding the Price, was answered, He should have them for 16 Pounds

Pounds the Piece, one with another. The Gentleman bids him 15 Pounds *per* Piece, and take all. The young Spark tells him it would not be taken: But, says he, If you will give me what the last Ox will come to, by doubling the whole Number by a Farthing, you shall have all; to which the Gentleman assents. The Question is, What the Gentleman paid for the Oxen?

Four or five of the first Terms are easily got, as thus,

0 1 2 3 4 5 Exponents.  
1 2 4 8 16 32 Terms.

*Nota.* You need only to find that Term which will answer the Exponent 22, which will be the 23d Term; because the Exponents are less by one than the Terms; for in this Method we account not the first Term, which the Learner is desired carefully to observe.

So if I multiply the 5th Term 32 by itself, it gives the 10th Term 1024, by *Theorem* 10; which multiplied again by itself gives 1048576, which is the 20th Term from the first; but taking the first into the Number, is the 21st Term; and seeing I want two Terms more, I multiply this last Product, by the Term under the Exponent 2, which is 4, which gives 4194304, the last Term, and the Price of the Oxen in Farthings, which makes 4369  $\frac{1}{4}$  s. 4 d., a great Rate to pay for so many Oxen.

### P R O P. II.

In any Geometrical Progression not proceeding from Unity, the Ratio being known, and the first Term, to find any Remote Term without producing all the intermediate Terms.

### R U L E.

Find a few of the leading Terms, as in the last, and multiply the last by itself, and divide the Product by the first, or leading Term, the Quote gives a Term doubly distant from the first, by *Theorem* 12; and this again multiplied by itself, and divided by the first Term, gives a Term doubly distant from the last Term. Thus do until either you have the Term sought, or one that falls a little short; if so, multiply the last Term found by that Term answering to the Difference of their Exponents;



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**EXAMPLE.**

### EXAMPLE.

Calculate five or six of the first Terms, as here we have found five.

Then multiplying the 5th, 7776 by itself, it will produce 60466176, and this divided by 1024, the first Term, quotes the 10th Term, or what the eldest Son must have.

If the whole Estate had been demanded, it may be found by *Theorem 15*, to be 175099 Crowns.

**P R O P. III.**

## R U L E.

## RULE.

T

Other

April  
- 7/10 -

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Otherwise, or in other Words thus; the Difference of the greatest and least Terms divided by the Excess minus Unity, the Quotient multiplied by the Excess, and to the Product adding the first Number, the Sums are equal to the Total.

Or, according to Corollary in Theorem 13, it holds, That if the Ratio of your Progression be double, the Difference of the greatest and least added to the greatest, gives the Total Sum.

If the Ratio be triple,  $\frac{2}{3}$  the Difference added to the greatest is the Total. If the Ratio be quadruple,  $\frac{3}{4}$  of the Difference added to the greatest, is equal to the Total Sum of the rest. And so on.

### EXAMPLE.

A Merchant having a soft young Man to his Son, covetous enough, but scarce able to keep a Shop-Book, was minded to purchase for him some considerable Lands in the Country; and bid him enquire out some handsome Estate that would be sold, and he would buy it for him: The young Man, overjoyed at the News, runs to an Inn, where he heard diverse Country-Gentlemen lodg'd; and in all Haste ask'd them if any of them would sell their Estate; most of them were very angry, and near beating of him; but one of them being a facetious Gentleman, resolv'd to put a Trick upon him; and told him, That he had a neat Hall, with a goodly Park and Manor, on the Bank of a pleasant River, and a great Number of sufficient Tenants; all which, with the Royalty of a fair Market-Town, and the Patronage of a Parish Church, belonging thereto, should be his, upon Condition he would lay him down one Penny on the Threshold of the Porch-Door belonging to the Hall, Two-pence at the next Door, Four-pence at the 3d Door, and so on doubling, 'till he had gone thro' all the Doors, which were 64 in all. 'I'll have it, saith the young Man, and here's a Piece in Earnest; and in all Haste tells his Father what a Purchase he had made, wishing him to give him an Hundred Pounds, for that he thought could not but abundantly satisfy. Thou Calf, quoth his Father, the King of Spain's Revenues would not pay what thou hast promised, if they were sold at 20 Years Value, much less can my Estate pay for thy Purchase,

## Geometrical PROGRESSION. 143

Purchase, for it will not bring thee past the 24th Threshold. The best is, the Gentleman knows thee not; and if he did, he could get no Advantage of one that has nought; but I'll warrant thee, he is making merry with a Fool's Earnest. Now I desire to know what the Sum to be laid down on the 24th Threshold was, and what the Whole, which he promised, would have come to?

*First*, The Sum to be laid down on the 24th Threshold, by *Prop. 1*, will be found to be 8388608 Pence. And by this *Proposition* the Sum of the whole unto the 24th Threshold will be found to be 16777215 Pence, equal to 66905 *l.* 1 *s.* 3 *d.* which the Father must be worth, else he could not bring him over the 24th Threshold.

*Secondly*, The Number to be laid down on the 64th Threshold, by the said first *Proposition*, 9223372036854775808 Pence; and by this *Proposition*, the Sum of the Whole, which the young Man should have given for the Purchase, will be 18440744073709551615 Pence, equal to 76861433640456465 Pounds, 1 Shilling and 3 Pence; by which it may appear the Gentleman spoke within Compass; for this Sum would purchase the yearly Rent of 3843071682022823 *l.* 5 *s.* 0 *d.*  $\frac{2}{3}$  which is a great deal more than the King of Spain's Revenues are worth: For supposing his Revenues were worth One Hundred Millions *per Ann.* (which I think no Potentate of the Earth is worth) it would be no more considerable to the Sum last mentioned, than a Red-Herring, of an Ounce Weight would be to the loading of 20 Ships of 50 Ton Burthen a-piece, which may be thus demonstrated; for allowing 20 Hundred to the Ton, the whole Number of Ounces, equal to the Burthen of so many Ships of such Capacity, will be 35840000; and this Number of Ounces multiplied by One Hundred Million, is only 3584000000000000, which is less than the foregoing Number by 259071682022823, which is a Number large enough to load a great many more Ships.

### EXAMPLE II.

What will a Horse cost by trebling the Nails in his Shoes (which are 32) with a Farthing?

*Answer* 965114681693 *l.* 13 *s.* 4 *d.*



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*See the Work.*

|          |      |               |       |
|----------|------|---------------|-------|
| Nails 1= | 1    | The 8th Nail= | 2187  |
| 2=       | 3    | Multiply by   | 2187  |
| 3=       | 9    |               | ————  |
| 4=       | 27   |               | 15309 |
| 5=       | 81   |               | 17496 |
| 6=       | 243  |               | 2187  |
| 7=       | 729  |               | 4374  |
| 8=       | 2187 |               | ————  |

4782969

Trebled is 14348907=the 16th Nail.

Multiply by the same 14348907

100442349

129140163

114791256

57395628

43046721

57395628

14348907

205891132094649

Trebled 617673396283947 =

And the whole Sum will be 926510094425920 Farthings.

## **EXAMPLE III.**

A Gentleman having a Coat and Waste-coat with 12 Dozen of Silver Plate Buttons; A Baker seeing it, and fancying it, demands of the Gentleman the Price thereof; who answered, If he would double every Button with a Barley-Corn, proceeding from the first gradually to the last, it should be his. To which the Baker assents.

I demand the Number of Barley-Corns, together with the Worth and Weight of the same?

*Observe*

Observe the following Work.

|             |     |                    |                    |
|-------------|-----|--------------------|--------------------|
| Buttons 1 = | 1   | the 9th But. = 256 | 18th But. = 131072 |
| 2 =         | 2   | 256                | 131072             |
| 3 =         | 4   |                    |                    |
| 4 =         | 8   | 1536               | 262144             |
| 5 =         | 16  | 1280               | 917504             |
| 6 =         | 32  | 512                | 131072             |
| 7 =         | 64  |                    | 393216             |
| 8 =         | 128 | 65536              | 131072             |
| 9 =         | 256 | 18th But. 131072   |                    |

The 36 Button = 34359738368  
34359738368

274877906944  
206158430208  
103079215104  
274877906944  
103079215104  
240518168576  
309227645312  
171798691840  
103079215104  
137438953472  
103079215104

1180591620717411303424

The 72d Button = 2361183241434822606848

Which last Number must be multiplied by itself, and then by the common Excess, and so you will have what the last Button will amount to.

See

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See the rest of the Work.

The 72d Button = 2361183241434822606848

2361183241434822606848

18889465931478580854784

9444732965739290427392

18889465931478580854784

14167099448608935641088

14167099448608935641088

4722366482869645213696

4722366482869645213696

18889465931478580854784

9444732965739290427392

7083549724304467820544

444732965739290427392

2361183241434822606848

9444732965739290427392

4722366482869645213696

7083549724304467820544

18889465931478580854784

2361183241434822606848

2361183241434822606848

14167099448608935641088

7083549724304467820544

4722366482869645213696

---

5575186299632655785383929568162090376495104 Button.  
11150372599265311570767859136324180752990208 = 144

---

22300745198530623141535718272648361505980415 T.Sum.

---

Which last Number is the exact Quantity of Barley, which the whole 12 Dozen of Buttons will amount to. Now for the Worth.

An Ounce *Averdupois* had been exactly weighed, and found to contain 681 Grains of Barley; therefore a Pound *Averdupois* would contain 10896 Grains: And seeing a Bushel of the same Barley weighed 50 Pounds, the Grains in a Bushel will be 544800. Wherefore dividing the whole Number of Barley-Corns by 544800, the Number of Bushels will



will be as here 409338301147772084095736385327613-  
09665, and above  $\frac{1}{2}$ , and esteeming Barley at 2 Shillings  
the Bushel, the Value of the whole Quantity of Barley  
will be 4093383011477720840957363853276130966  $\frac{1}{2}$   
11 s. and 11 d.  $\frac{1}{2}$ , which in Words at length is Four Mil-  
lions of Millions of Millions of Millions of Millions of  
Millions, Ninety three thousand three hundred eighty  
three Millions of Millions of Millions of Millions of Mil-  
lions, Eleven thousand four hundred seventy seven Mil-  
lions of Millions of Millions of Millions, Seven hundred  
twenty thousand eight hundred forty Millions of Millions  
of Millions, Nine hundred fifty seven thousand three  
hundred sixty three Millions of Millions, Eight hundred  
fifty three thousand two hundred seventy six Millions,  
One hundred and thirty thousand nine hundred sixty six  
Pounds, Eleven Shillings and Eleven Pence half Penny.  
Which Sum is so vastly great, that if the whole Globe  
of the Earth and Sea, with whatsoever is contained on or  
therein, were converted into solid Gold, and coined in-  
to Guineas of equal Quantity with those we now have,  
and to be valued at 30 s. per Piece; a hundred of such  
Guineas would come as near purchasing all the Land  
upon the Face of the whole Earth, as the said Quantity  
of Guineas would purchase all that Barley; which may  
seem as a Paradox, yet may easily be demonstrated to be  
true.

For suppose every Degree of the Meridian Circle an-  
swer to 80 *English* Miles upon the Earth, which Suppo-  
sition is too much, none yet having accounted above 73;  
and Mr. *Norwood* by Experiment found only 69, and  
something above  $\frac{1}{2}$  to answer to a Degree on the Earth;  
but supposing 80 Miles, that we may not take too little,  
the Circumference of the Earth in Miles is 28800, and  
in Inches is 1824768000, and the Solidity is 106565851-  
563063758385315840 Inches; and computing Guineas  
at one Pound ten Shillings per Piece, and to weigh five  
Penny Weight nine Grains, as they ought to do, a solid  
Inch of Gold would be worth 55 l. 7 s. but according to  
the Account concerning the Value of Gold given by  
*Jonas Moore* in his *Mathematical Compendium*, p. 16. a  
solid Inch of Angel Gold (which is the best) will be worth  
33 l. 16 s. 4 d. by which we may see how Guineas are  
advanced

advanced above the Worth; but taking them according to the greater Rate, the Worth of the whole Globe of the Earth, converted into such Gold, will be 589870228352221145586952830 Pounds, 19 Shillings and 6 Pence.

And according to the former Computation, the square Miles on the Face of the whole Earth will be 2640190464, one third of which being allowed for Seas, the Remainder will be 1760126076 square Miles: And seeing a square Mile contains 640 square Acres, the Number of square Acres on the Face of the Earth will be 112648126464, and valuing an Acre at 20s. which is too much, accounting one with another, the Worth will be 2252062529280 Pounds, which may near as soon be purchased with a 100 Guineas, as the Barley before named with the whole Quantity of the said Gold.

Nay, if we suppose the Earth and Seas, and all contained therein, were converted into fine Sand, the Number of Grains of Sand would far come short of the aforesaid Number of Barley-Corns; so that the Bulk of Barley exceeds some Millions of our Earth we live upon, if it were possible to be brought into one Place.

And, lastly, if the Weight be considered, seeing a Bushel weighs 50 Pounds, the Weight of the whole will be 20466915057388604204786819266380654832594 Pounds, 13 Ounces, 3 Dram  $\frac{1}{2}$ . All this may seem impossible to any but an Accountant, who is the best Judge of the great and almost incredible Power of Numbers.

In the last Place we will annex a Table of *Geometrical Progression* fitted to the last Question, whereby any Question of *Geometrical Progression* proceeding from Unity, and of a *Duple Ratio*, may be resolved by Inspection, if the Number of Terms exceed not 144.

A T A B L E follows.

A TABLE of GEOMETRICAL PROGRESSION, proceeding from Unity, and continued to 144 Places, the Ratio, or common Excess, being 2.

|    |             |    |                       |
|----|-------------|----|-----------------------|
| 1  | 1           | 36 | 34359738368           |
| 2  | 2           | 37 | 68719476736           |
| 3  | 4           | 38 | 137438953472          |
| 4  | 8           | 39 | 274877906944          |
| 5  | 16          | 40 | 549755813888          |
| 6  | 32          | 41 | 1099511627776         |
| 7  | 64          | 42 | 2199023255552         |
| 8  | 128         | 43 | 4398046511104         |
| 9  | 256         | 44 | 8796093022208         |
| 10 | 512         | 45 | 17592186044416        |
| 11 | 1024        | 46 | 35184372088832        |
| 12 | 2048        | 47 | 70368744177664        |
| 13 | 4096        | 48 | 140737488355328       |
| 14 | 8192        | 49 | 281474976710656       |
| 15 | 16384       | 50 | 562949953421312       |
| 16 | 32768       | 51 | 1125899906842624      |
| 17 | 65536       | 52 | 2251799813685248      |
| 18 | 131072      | 53 | 4503599627370496      |
| 19 | 262144      | 54 | 9007199254740992      |
| 20 | 524288      | 55 | 18014398509481984     |
| 21 | 1048576     | 56 | 36028797018963968     |
| 22 | 2097152     | 57 | 72057594037927936     |
| 23 | 4194304     | 58 | 144115188075855872    |
| 24 | 8388608     | 59 | 288230376151711744    |
| 25 | 16777216    | 60 | 576460752303423488    |
| 26 | 33554432    | 61 | 1152921504606846976   |
| 27 | 67108864    | 62 | 2305843009213693952   |
| 28 | 134217728   | 63 | 4611686018427387904   |
| 29 | 268435456   | 64 | 9223372036854775808   |
| 30 | 536870912   | 65 | 18446744073709551616  |
| 31 | 1073741824  | 66 | 36893488147419103232  |
| 32 | 2147483648  | 67 | 73786976294838206464  |
| 33 | 4294967296  | 68 | 147573952589676412928 |
| 34 | 8589934592  | 69 | 295147905179352825856 |
| 35 | 17179869184 | 70 | 590295810352705651712 |



| TABLE OF GEOMETRICAL PROGRESSION, proceeding from 1 to 144 Places, in Excess, being 2. |                                   |
|----------------------------------------------------------------------------------------|-----------------------------------|
| 71                                                                                     | 1180591620717411993424            |
| 72                                                                                     | 2361183241434822606848            |
| 73                                                                                     | 4722366482860641513696            |
| 74                                                                                     | 944473296573920427392             |
| 75                                                                                     | 18889465931478580854784           |
| 76                                                                                     | 37778931862957161709568           |
| 77                                                                                     | 75557863725914323419136           |
| 78                                                                                     | 151115727491828646838272          |
| 79                                                                                     | 302231454993657293676544          |
| 80                                                                                     | 604462909807314587353088          |
| 81                                                                                     | 1208925819616629174766176         |
| 82                                                                                     | 2417851639229258349412352         |
| 83                                                                                     | 4835703278458516698824704         |
| 84                                                                                     | 9671406556917033397649408         |
| 85                                                                                     | 19342813113834006795298816        |
| 86                                                                                     | 38685626227668133590597632        |
| 87                                                                                     | 77371252455336267181195264        |
| 88                                                                                     | 154742504910672534362390528       |
| 89                                                                                     | 309485009821345068724781056       |
| 90                                                                                     | 618970019642690137449562112       |
| 91                                                                                     | 1237940039285380274899124224      |
| 92                                                                                     | 2475880078570760549798248448      |
| 93                                                                                     | 4951760157141521099596496896      |
| 94                                                                                     | 9903520314283042199192993792      |
| 95                                                                                     | 19807040628566084398385987584     |
| 96                                                                                     | 39614081257132168796771975168     |
| 97                                                                                     | 79228162514264337593543950336     |
| 98                                                                                     | 158456325028528675187087900672    |
| 99                                                                                     | 316912650057057350374175801344    |
| 100                                                                                    | 633825300114114700748351602688    |
| 101                                                                                    | 1267650600228229401406703205376   |
| 102                                                                                    | 2535301200456458802993406410752   |
| 103                                                                                    | 5070602400912917605986812821504   |
| 104                                                                                    | 10141204801825835211973625643008  |
| 105                                                                                    | 20282409603651670423947251286016  |
| 106                                                                                    | 40564819207303340847894502572032  |
| 107                                                                                    | 81129638414606681605789005144064  |
| 108                                                                                    | 162259276829213363391578010288128 |
| 109                                                                                    | 324518553658426726783156020576256 |
| 110                                                                                    | 649037107316853453566312041152512 |

# Geometrical PROGRESSION.

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|     |                                              |
|-----|----------------------------------------------|
| 111 | 1298074214633706907132624082305024           |
| 112 | 2596148429267413814265248164610048           |
| 113 | 5192296858534827628530496329220096           |
| 114 | 10384593717069655257060992658440192          |
| 115 | 20769187434139310514121985316880384          |
| 116 | 41538374868278621028243970633760768          |
| 117 | 83076749736557242056487941267521536          |
| 118 | 166153499473114484112975882535043072         |
| 119 | 332306998046228968225951765070086144         |
| 120 | 664613997892457936451903530140172288         |
| 121 | 1329227995784915872903807060280344576        |
| 122 | 2658455991569831745807614120560689152        |
| 123 | 5316911983139663491615228241121378304        |
| 124 | 10633823966279326983230456482242756608       |
| 125 | 21267647932558653966460912964485513216       |
| 126 | 42535295865117307912921825928971026432       |
| 127 | 85070591730234615865843651857942052864       |
| 128 | 170141183460469231731687303715884105728      |
| 129 | 340282366920938463463374607431768211456      |
| 130 | 680564733841876926926749214863536422912      |
| 131 | 1361129467683733853833498429727072845824     |
| 132 | 272258935367507707706996859454145691648      |
| 133 | 5444517870735015415413993718908291383296     |
| 134 | 10889035741470030830827987437816582766592    |
| 135 | 21778071482940061661655974875633165533184    |
| 136 | 43556142965880123323311949751266331066368    |
| 137 | 87112285931760246646623899502532662132736    |
| 138 | 174224571863520493293247799005065324265472   |
| 139 | 348449143727040986586495598010130648530944   |
| 140 | 696898287454081973172991196020261297061988   |
| 141 | 1393796574908163946345982392040522594123776  |
| 142 | 2787593149816327892691964784081045188247552  |
| 143 | 5575186299632655785383929568162090376495104  |
| 144 | 11150372599265311570767859136324180752990208 |

Take an Example or two in the Use of the aforegoing Table.

## QUEST. I.

What will 20 Pieces of Cloth cost by doubling every Piece by a Farthing? And supposing every Piece to contain

U 2

tain

# 152 Geometrical PROGRESSION.

tain 50 Yards, and each Yard worth 1 *l.* 1 *s.* 8 *d.* what will the Difference be in the Price?

## R U L E.

Subtract Unity from the 21st Number, gives 1048575 Farthings, which reduced, is 1092 *l.* 5 *s.* 3 *d.* 3 *q.*

And multiplying 20 by 50 gives 1000, the Number of Yards, which at 1 *l.* 1 *s.* 8 *d.* the Yard, will amount to 1083 *l.* 6 *s.* 8 *d.* which subtracted from the former Number, gives 8 *l.* 18 *s.* 7 *d.* 3 *q.* the Difference sought.

## Q U E S T. II.

A certain Man whose Daughter was married on *New-Year's-Day*, gave her Husband towards her Portion One Shilling, promising to double it on the first Day of every Month for one whole Year; I demand what was her Portion?

Subtract an Unit from the 13th Number, being one Number more than the Number of Months, and the Remainder is 4095 Shillings, or 204 *l.* 15 *s.* the *Answer*. And thus of any other.

Or, suppose the Progression be *Quadruple* (supposing the Progression proceeds from Unity) the last Number may be found by the Table, by subtracting an Unit from the double Number of Terms given.

## E X A M P L E.

What will 9 Packs of Broad Cloth cost by quadrupling every Pack by one Shilling?

From the double Number of Terms subtracting an Unit, leaves 17, and the 17th Number in the Table is 65536, the Number of Shillings the last Pack will cost, and  $\frac{1}{8}$  of the Difference of the last and first Term added to the last, gives 87381 Shillings, or 4369 Pounds, One Shilling, for the Price of the whole, by *Theorem* the 5th.

More Examples and more Uses might be shewn, but let these suffice.



(H 153)

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## The Combination, Election, Permutation and Composition of Numbers or Quantities.

**C**ombination of Numbers, is how oft a less Number of Quantities may be taken out of a greater Number of Quantities, without considering their Places.

As if 10 Letters of the Alphabet, *a . b . c . d . e . f . g . h . i . k* were given, and it were required to know how many Combinations of 2 Letters, as *ab . ac . ad*, &c. may be taken in the said 10 Letters; or how many Combinations of 3 Letters, as *abc . abd . abe*, &c. may be found in the same Letters.

### E X A M P L E.

How many Combinations of two Letters in 8, (*viz.*)

*a . b . c . d . e . f . g . h*?

*First*, It is easily seen *a* will combine with all the following Letters, *b . c . d . e . f . g . h*, from whence will arise 7 Combinations to wit, *ab . ac . ad . ae . af . ag . ah*.

*Secondly*, *b* will be combined with all following itself (but not with *a*, for *ba* is all one as *ab*) as *c . d . e . f . g . h*; whence will arise 6 Combinations, *viz. bc . bd . be . bf . bg . bh*; and so every Letter will combine with those following itself, as may be seen at large in the following Table.

In

In all 28 Combinations, which is the Answer.

And if to every Binary already found, be added its following Letters, it will produce the Ternaries, or all the Combinations of 3 Letters, as in the following Synopsis is evident.

*ab . ac . ad . ae . af . ag . ah*  
*bc . bd . be . bf . bg . bh*  
*cd . ce . cf . cg . ch*  
*de . df . dg . dh*  
*ef . eg . eh*  
*fg . fh*  
*gh*

In all 56 Combinations.

Again, If to every Ternary already found, be added its following Letters, it will produce all the Combinations, on 4 Letters in 8. And so of any other.

*abc . abd . abe . abf . abg . abh*  
*acd . ace . acf . acg . ach*  
*ade . adf . adg . adh*  
*aef . aeg . aeh*  
*afg . afh*  
*agh*

*bcd . bce . bcf . bcg . bch*  
*bde . bdf . bdg . bdh*  
*bef . beg . beh*  
*bfg . bfh*  
*bgh*

*cde . cdf . cdg . cdh*  
*cef . ceg . ceh*  
*cfg . cfh*  
*cgh*

*def . deg . deb*  
*dfe . dfh*  
*dgh*

*efg . efh*  
*egh*  
*fgh*

But because this may seem tedious in large Numbers, we have here exhibited another Method, whereby to find the Combinations in any given Numbers or Quantities with much Ease.

### THUS:

Having placed the given Number of Quantities by itself, decrease it gradually by an Unit so often as there are Quantities in the Combination, placing them one after another with a Sign of Multiplication betwixt them; which

which Numbers must be multiplied into one another for a Dividend: then placing an Unit with the like Number of Places, decreasing by Unity with the Sign of Multiplication betwixt each, multiply them continually for a Divisor, and the Quotient will be the Number of Combinations sought.

EXAMPLE

How many Combinations of 5 Letters in 10? *Facit* 252.

$$5 \times 4 \times 3 \times 2 \times 1 = 10 \times 9 \times 8 \times 7 \times 6 \quad (252)$$

The Product of the Divisor is 120.

The Product of the Dividend is 30240.

And the Quotient will be 252.

Which will be the Number of Combinations of 5 Letters in 10.

EXAMPLE II.

A Country Farmer going to a Fair, makes a Bargain with a Moorlander for 50 Sheep, which were to be chosen out of 100; but he thinking him long in chusing them, tells the Farmer, that if he would give him a Farthing for every Parcel of 50 Sheep, which may be taken out of the said 100, he should have the whole Hundred; to which the Farmer assents. The Question is what they will cost.

If you work according to the Rule last laid down, the Number of Combinations of 50 in 100 will be 10089130-6544874079257172497256; which Number of Farthings reduced into Pounds, Shillings, and Pence, will be 63428-444317577165892888017 Pounds, 19 Shillings, 6 Pence; which Sum is so great, that if any Man were able to pay a Hundred thousand Pounds a Day, he would be above Sixty Thousand Millions of Millions of Years in paying it. Such a Vanity may be concluded for want of Judgment.

*Note,* In any given Number of Quantities, the Number of Combinations increase gradually, 'till you come about the mean Numbers, and so decrease gradually again. So in 8 Quantities, there are more Combinations of 3 and 5, than of 2 and 6, and more of 2 and 6, than of 1 and 7, as may be seen in the following Table.

*Note,*



## 156 Of Election of QUANTITIES.

*Note.* Farther, That if the Number of Quantities be even,  $\frac{1}{2}$  the Number of Places shews the greatest Number of Combinations that can be made in those Quantities. So if the Number of Quantities be 8, the of which is four, shews the greatest Number of Combinations in these Quantities will be of 4 in 8, as in the Table.

|   |    |
|---|----|
| 1 | 1  |
| 2 | 28 |
| 3 | 56 |
| 4 | 90 |
| 5 | 56 |
| 6 | 28 |
| 7 | 8  |
| 8 | 1  |

But if the Number of Quantities be odd, then those two Numbers which are next together, and whose Sum is equal to the given Number of Quantities, shew the greatest Number of Combinations; so of 7 Quantities the greatest Number of Combinations will be of 3 and 4 Quantities in 7, and are equal as in the Table.

|   |    |
|---|----|
| 1 | 7  |
| 2 | 21 |
| 3 | 35 |
| 4 | 35 |
| 5 | 21 |
| 6 | 7  |

A Question to the former or last Note.

### EXAMPLE.

How many Locks whose Wards differ, may be unlocked with a Key of 8 several Wards?

*Answer.* 255 Locks, 8 whereof may have one single Ward, 28 double Wards, 56 treble Wards, 70 four Wards, 56 five Wards, 28 six Wards, 8 seven Wards, and 1 Lock eight Wards.

## Of Election of QUANTITIES.

By Election of Quantities is meant, any Number of Quantities given, how many several Ways I may take them without respect had to their Places, as *A. B. C.* may be taken 7 Ways, viz. *a. b. c. ab. ac. bc. and abc.*

The Election of Quantities may easily be found out by the Geometrical Table of Progression foregoing; thus, to the given Terms add the Sum; seek in the first Column of the Table, and from the Number over-against it subtract an Unit; the Remainder is the Number of Elections sought.

### EXAMPLE.

How many Elections are there of the Letters of the Alphabet?

Look

## Of Variation of QUANTITIES. 157

Look in the first Column of the Table for 25, and over-  
against it is 16777216 — the 24th Power of 2.

Subtract 1 from it

Remainder 16777215, The Number of Elections of 24  
Letters.

## Of Variation of QUANTITIES.

By Variation of Quantities is meant how many several  
Ways any given Number of Quantities may be changed,  
as in respect to their Places.

As *a. b.* may be changed into *b. a.* and *a. b. c.* may be  
changed 6 Ways (*viz.*) *abc. acb. bac. bca. cab. cba.*

### EXAMPLE.

How many Changes may be rung on five Bells?

### RULE.

Multiply 1, 2, 3, 4, 5, one into another, the last Pro-  
duct is the Answer.

1 Admits of no Variation.

2

So on 5 Bells may be

rung 120 Changes.

2 Admits of 2 Variations.

3

And on 6 Bells may be

rung 720 Changes.

6 Admits of 6 Variations.

4

24 Admits of 24 Variations.

5

And thus of any other

Number of Bells. 120 5 Admits of 120 Variations.

### EXAMPLE II.

A young Scholar, but an Arithmetician, coming into  
a Town for the Convenience of a good Library, demands  
of a Gentleman with whom he lodged, what his Diet  
would cost for a Year? The Gentleman asks him 10 £.  
the Scholar answered he was not certain what Time he  
might stay, and would know what he must give him for  
his Diet so long as he could place his Family (consisting  
of 6 Persons besides himself) every Day at Dinner in a

X

contrary

### 158 *Variation and Composition of Quantities.*

contrary Position? The Gentleman considering of it, and thinking it could not be long, tells him he would allow him his Diet so long for 5 Pounds; to which the Scholar assents.

The Question is, what he gave for his Table *per An.*?

The Changes on 7 Quantities will be found to be 2024 which divided by 365, the Days in a Year, give 13 Years, 808, or 10 Months and 15 Days; and so long must he board the Scholar, according to the former Conditions, which will hardly amount to 7 Shillings and 3 Pence *per Annum*.

#### *E X A M P L E III.*

How many several Combinations with their Variations are there of Three Letters of the *English Alphabet*?

#### *R U L E.*

Multiply all its several Combinations 2024 by its Changes 6, and the Product 12144 is the Number of placing three Letters of the Alphabet with all its Variations.

From this Mutability of Variations and Combinations, it is no Marvel that by 24 Letters there ariseth and is made such Variety of Languages in the World, and such infinite Number of Words in each Language, seeing the Diversity of Syllables produceth that Effect, and also by interchanging and placing of Letters amongst the Vowels and among themselves, make those Syllables; for the Alphabet of 24 Letters may be varied thus many times (*viz.*) 620448401733239439360000.

Now if you take in the Combinations with the several Variations of 2, 3, 4, 5, 6, &c. Letters, there may be made and composed such a vast Number of Words, that if a Man could read 50 Thousand Words in an Hour, which is more than the *Psalms of David* contain (a Task too great for any Man to perform) and if there were a Hundred Thousand Millions of Men, they would not speak these Words, according to the hourly Proportion before mentioned, in a hundred Thousand Years; a thing seeming most impossible and incredible, yet most certain and infallible in Computation.

Hence likewise it may appear how many Ways the Letters of a Name or Word may be varied, and differently disposed by way of Anagram; out of which those of



## Variation and Combination of Quantities. 159

Use may be gathered, neglecting the rest; as for Example, the Word *Roma*, consisting of 4 different Letters, may admit of 24 Changes, as hereafter.

|                            |                                  |
|----------------------------|----------------------------------|
| <i>Roma Orma Mroa Arom</i> | Of which these, to wit,          |
| <i>Roam Oram Mrao Armo</i> | <i>Roma, Ramo, Oram, Mroa,</i>   |
| <i>Rmaq Omra Mora Aorm</i> | <i>Maro, Armo, Amor,</i> are on- |
| <i>Rmau Omar Moar Aaur</i> | ly useful, and all the rest      |
| <i>Raom Oarm Maro Amro</i> | useless.                         |
| <i>Ramo Oaur Maor Amor</i> |                                  |

But if there be two or more Letters of a Sort, divide the whole Number of Changes by the Changes of the Number of those Letters, and the Quotient is the Number of Changes desired.

So if the Word *Philippa* were given, which consisteth of 8 Letters, of which (without considering those which are of the same Sort) the Changes will be 40320; but because *I* is twice repeated, I divide 40320 by 2, the Changes on 2 Letters, the Quote is 20160, and this divided again by 6 the Changes on 3, because *P* is thrice repeated, gives in the Quotient 3360, which are the Changes in the Word *Philippa*.

Or if I had divided 40320 by 12 (because 2 times 6 is 12) the Quotient will give in the Answer, at one Operation, the same as before.

After this Manner may be found the Variations or Changes which may be made of some particular Latin Verses, so as to keep the Rules of a true Verse, and the Sense grammatically the same.

So if the two following Verses were chosen (*viz.*)

*Lex, Rex, Grex, Res, Spes, Jus, Tbus, Sal, Sol,*  
(bona) *Lux, Laus.*

*Mars, Mors, Sors, Fraus, Fex, Styx, Nox, Crux,*  
*Pus, (mala) Vis, Lis.*

It is very remarkable how many sundry Ways the same may be varied, and yet the Sense remain good, and the Verse grammatically true; for if we suppose the Words *Bona* and *Mala* continually to keep the same (to wit, the 10th) Place, the rest being 11 in Number, indifferently changing place with any other in the same Verse; the Number of Variations of 11 Places will be 39916800, which doubled for the Number of Changes in both Verses,

## 160 *Of Composition of* QUANTITIES.

makes 79833600, which would compose above 249 *Folio* Volumes, each Volume to contain 2000 Pages, every Page divided into two Parts, and every Part to contain 80 Verses, which at a Penny the Sheet, would amount to 518 Pounds, 15 Shillings; and supposing them bound for 5 Shillings a Volume, which is not dear, the Binding would cost 62 Pounds 5 Shillings; and the Worth of the Whole would be 581 Pounds.

### *Of Composition of* QUANTITIES.

By *Composition of Quantities* is meant, when in any Number of given Quantities, as in Letters or Figures, one Row is joined with another Row of the same, or with 2, 3 or more other Rows, as in placing, and the Chances of the Dice.

This differs from *Combination* and *Election*, in that there one Quantity is taken but once, here as oft as there are Quantities to be taken.

Though this be the most composed Way, yet it is not difficult to be performed; for if the Compositions of two Quantities in 10 (or any other Number) were sought, it is but squaring the given Number; if of three Quantities in 10, it is cubing the given Number; if of 4 Quantities, its Biquadratick will fit, and so increase the Powers, according as your Number of Quantities increase.

#### EXAMPLE I.

What Number of Compositions of 3 Letters in 20? *Facit* 8000, the Cube of 20.

#### EXAMPLE II.

What Number of Compositions of 6 Letters in 24, or in the whole Alphabet? *Answer* 191102976 the squared Cube of 24.

#### EXAMPLE III.

What Number of Compositions of 24 Letters of the Alphabet, accounting them by 1 and 1, by 2 and 2, by 3 and 3, and so on to 24? If we account each Time 24, the Answer would be 1333735776850284124449081472843776; but since we are to find all the Numbers preceding in Geometrical Progression under it; to perform which, observe the following *Rule*.

As

# Of Composition of QUANTITIES. 161

As the Ratio *minus* Unity : Is to the first Term :: So the whole Power of the Ratio *minus* Unity : To the Sum of all the Terms.

Thus Stated.

As 23 : To 24 :: So 133373577685028412444908147-2843776 : To 1391724288887252999425128493402200 which is the Number of Compositions sought.

How many several Chances are there on 2, 3, 4, 5, and 6 Dice?

Answer, On 2 Dice are 36, on 3 Dice 216, on 4 Dice 1296, on 5 Dice 7776, and on 6 Dice 46656 Chances.

| Casts. | Points. | Chances. | Sum. |
|--------|---------|----------|------|
| 2 . 12 | 1 . 1   | 1        | 1    |
| 3 . 11 | 1 . 2   | 2        | 2    |
| 4 . 10 | 1 . 3   | 2        | 3    |
|        | 2 . 2   | 1        |      |
| 5 . 9  | 1 . 4   | 2        | 4    |
|        | 2 . 3   | 2        |      |
| 6 . 8  | 1 . 5   | 2        | 5    |
|        | 2 . 4   | 2        |      |
|        | 3 . 3   | 1        |      |
| 7      | 1 . 6   | 2        | 6    |
|        | 2 . 5   | 2        |      |
|        | 3 . 4   | 2        |      |

The foregoing Table shews the several particular Chances on two Dice. The Sum of the Chances of 2 . 3 . 4 . 5 . 6 Casts are 15, and of 12 . 11 . 10 . 9 . 8, are 15. Then add the Chances on 7 (*viz.*) 6, gives 36, the Chances on 2 Dice.

The particular Chances on 2 Dice, otherwise formed, whereby the following Observations may be made.

|     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|
| 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 |
| 2.1 | 2.2 | 2.3 | 2.4 | 2.5 | 2.6 |
| 3.1 | 3.2 | 3.3 | 3.4 | 3.5 | 3.6 |
| 4.1 | 4.2 | 4.3 | 4.4 | 4.5 | 4.6 |
| 5.1 | 5.2 | 5.3 | 5.4 | 5.5 | 5.6 |
| 6.1 | 6.2 | 6.3 | 6.4 | 6.5 | 6.6 |

O B.



# 162 *Of Composition of QUANTITIES.*

## OBSERVATIONS.

Here are 36 Chances the Square of 6, as before; all the Chances of 6 are placed in the lowermost and furthermost Row; whence observe, That in the Square of 5 (*viz.*) 25, there is no 6: So there are 25 Chances without 6, and 11 more where there is a 6: So that it is above two to 1 whoever throws 2 Dice, throws not a 6. In the Square of 4 (*viz.*) 16, there is neither 5 nor 6. In the Square of 3 (*viz.*) 9, there is neither 4, 5 nor 6. In the Square of 2 (*viz.*) 4, there is neither 3, 4, 5 nor 6. This may be applied to other Chances.

*A TABLE of the Powers of 6, and the Numbers under it.*

| 1          | 2        | 3        | 4         | 5         | 6         |
|------------|----------|----------|-----------|-----------|-----------|
| <i>Lat</i> | <i>q</i> | <i>c</i> | <i>bq</i> | <i>ff</i> | <i>fc</i> |
| 1          | 1        | 1        | 1         | 1         | 1         |
| 2          | 4        | 8        | 16        | 32        | 64        |
| 3          | 9        | 27       | 81        | 243       | 729       |
| 4          | 16       | 64       | 256       | 1024      | 4096      |
| 5          | 25       | 125      | 625       | 3125      | 15625     |
| 6          | 36       | 216      | 1296      | 7776      | 46656     |

By this Table may be accounted, how many several Chances there are on 2, 3, 4, 5 or 6 Dice, and how many there are where there is no 6, or neither 5 nor 6, or neither 4, 5 nor 6, or neither 3, 4, 5 nor 6.

## EXAMPLE.

On 4 Dice there are 1296 Chances, 625 where there is no 6, 256 where there is neither 5 nor 6, 81 where there is neither 4, 5 nor 6, and 16 where there is neither 3, 4, 5 nor 6; but if it were demanded, on how many Chances on 4 Dice there is a 6, I answer 671; for 1296 minus 625, is equal to 671.

And 1040 Chances have either a 5 or 6; for 1296 minus 256, is equal to 1040.

Likewise 1215 Chances have either a 4, 5 or 6; for 1296 minus 81, is equal to 1215.

And

And lastly, 1280 Chances have either a 3, 4, 5, or 6, for 1296, minus 16, is equal to 1280. And so of any other in the Table.

To conclude, I shall here mention a small Treatise written not long since, entitled, *Artificial Versifying*, shewing any one, tho' of ordinary Capacity, that can write and read, tho' he understand not a Word of Latin, how to make Thousands of *Hexameter* and *Pentameter* Verses, which will be good Latin, true Verse, and perfect Sense, and that in two Hours time.

Which is performed by a select Number of Latin Words, artfully digested into Tables, the more to amuse the Reader.

The Words are these which follow.

In the Table of *Hexameters* the Words are,  
 1. *Turbida, Ignea, Possima, Horrida, Aspera, Martia, Barbata, Lurida, Effera,*  
 2. *Fata, Signa, Damna, Bella, Vincula, Sistra, Castra, Scorta, Tela.*

3. *Sequi, Fori, Pati, Tuis, Dami, Patis, Puso, Polam, Struunt, Præmonstrant, Præstant, Promittunt, Pretendunt, Producent, Monstrabunt, Causabunt, Parendant, Pro-mulgant.*

5. *Tempora, Pocula, Prælia, Verbera, Lumina, Fœdera, Agmina, Crimina, Sidera.*

6. *Dura, Saeva, Quædam, Acerba, Prava, Multa, Dira, Nigra, Sæva.*

Here if you take one Word out of each Line, you will have a true *Hexameter* Verse.

In the Tables of *Pentameters* the Words are,

1. *Totrica, Ardua, Perfida, Improbæ, Sordida, Impia, Tristia, Turpia, Noxia.*

2. *Præstabit, Præscribunt, Concludunt, Prædicunt, Perficiunt, Consummant, Conglomerant, Significant, Procurant.*

3. *Dura, Acta, Vina, Verba, Dicta, Facta, Labra, Arma, Astra.*

4. *Dolosa, Pudenda, Proterva, Nefanda, Cruenta, Superba, Molesta, Sinistra, Maligna.*

5. *Nequa, Aliis, Tibi, Viris, Scio, Mara, Malis, Vides, Mihi.*

Here

Here likewise if you take a Word out of every Line, you will have a true *Pentameter* Verse.

Now if it were required to find how many Verses may be composed out of the foregoing Words, seeing every Line hath 9 Words; I find the squared Cube of 9, because there are 6 Lines, which will be 531441; and so many Verses may be made out of the Tables of *Hexameters*, without taking Notice of the *Permutation* of Places; for you may change most of the 1st and the 6th Line into the 5th and 2d Line; which Verses will compose 30 Volumes as big, or bigger, than *Virgil*.

Likewise in the Table of *Pentameters* may be composed 59049 Verses, being the Surfold or 5th Power of 9; because there are 5 Lines, and 9 Words in every Line.

But if the *Combinations* of 6 in 14 for the *Hexameters*, or 5 in 45 the *Pentameters*, were required, the Answer will be in the first 25827165, in the latter 12217569; but because we are not to take two Words in a Line, these Numbers cannot be admitted.

And in the last Place, because the Contrivance may please and divert the Reader, we will here annex the Tables themselves, with the Manner of their Use, and so conclude this Rule.

The Tables of HEXAMETERS.

TABLE I.

|   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|
| T | i | p | h | a | m | b | l | e | m |
| g | e | o | s | a | a | u | f | r | n |
| f | r | p | r | r | r | f | b | e | s |
| r | e | t | b | i | e | d | a | i | l |
| r | i | a | d | r | d |   | m | d | a |
| a | r | a | a | a |   | a | a |   |   |
| a |   |   |   |   |   |   |   |   |   |

TABLE II.

|   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|
| F | s | d | b | v | s | c | s | t | a |
| r | a | e | i | i | a | c | e | t | g |
| m | l | n | s | s | o | l | a | n | n |
| l | c | t | t | r | a |   | a | a | a |
| l | r | r | t |   |   |   |   |   | a |
| a | a | a |   |   |   |   |   |   |   |



TABLE III.

|   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|
| s | f | p | t | d | p | p | p | f | e |
| o | a | u | o | a | u | a | e | q | r |
| t | i | m | t | t | l | r | u | i | i |
| s | i | e | o | a | u | i |   |   |   |
| t |   |   | m | n |   |   |   |   |   |
| o |   |   | t |   |   |   |   |   |   |

TABLE IV.

|   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|
| p | p | p | p | p | m | c | p | p | r |
| r | r | o | r | o | a | r | r | æ | o |
| o | r | o | n | u | æ | o | m | r | m |
| t | d | s | s | n | m | o | i | i | e |
| u | t | a | a | u | n | t | t | n | c |
| r | b | r | l | s | a | t | d | u | a |
| u | r | g | t | n | u | u | n | b | n |
| a | a | r | t | n | n | t | u | t | n |
| n | a |   | t | t | n |   | t | t | t |
| n |   |   |   |   | t |   |   |   | t |

TABLE V.

|   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|
| T | p | p | v | l | f | a | c | s | e |
| o | r | e | u | œ | g | r | i | m | c |
| æ | r | m | d | m | i | d | p | u | l |
| b | i | e | i | m | e | o | l | i | e |
| n | r | n | i | r | r | a | a | r | a |
| a | a | n | a | a |   | a |   |   |   |
| a |   |   |   |   |   |   |   |   |   |

TABLE VI.

|   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|
| D | s | q | a | p | m | d | n | s | u |
| æ | u | c | r | u | i | i | æ | r | p |
| æ | e | a | l | r | g | v | a | e | d |
| r | v | t | a | r | a |   |   | a | b |
| a | a |   | a |   |   |   | m | a |   |

## The Tables of PENTAMETERS.

TABLE I.

|   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|
| T | a | p | i | f | i | t | t | n | e |
| r | e | m | o | m | r | u | o | t | d |
| r | p | r | p | i | r | x | r | u | f |
| r | d | i | s | p | i | i | a | i | o |
| i | a | t | i | a | c |   | d | b | d |
|   | i | a |   | a |   | a | a | a |   |
| a |   |   |   |   |   |   |   |   |   |

TABLE II.

|   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|
| p | p | c | p | p | c | c | f | p | r |
| r | o | r | e | o | o | i | r | æ | æ |
| n | æ | r | n | n | g | o | f | f | c |
| d | f | f | g | n | c | t | c | l | l |
| i | u | l | i | u | a | r | u | c | c |
| m | o | f | r | b | i | d | u | i | m |
| m | i | a | u | b | u | n | u | a | e |
| c | n | n | u | n | t | n | n | r | a |
| t | t | n | t |   | t | t | a | n |   |
|   | t |   |   |   |   | n | t |   |   |
|   |   |   |   |   | t |   |   |   |   |

TABLE III.

|   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|
| D | a | v | v | d | f | l | a | a | u |
| c | i | c | i | a | a | r | f | r | t |
| n | r | c | c | b | m | t | a | a | a |
| b | t | t | r | a | r |   |   |   | a |
| a | a | a |   | a |   |   |   |   |   |

TABLE IV.

|   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|
| D | p | p | n | c | f | m | f | m | o |
| u | r | e | r | u | o | i | a | l | d |
| o | f | u | p | l | n | l | o | e | t |
| a | e | e | e | i | i | f | n | e | n |
| n | r | f | f | g | a | d | r | d | t |
| b | t | t | n |   | a | v | a | a | a |
| a | r | a |   |   | a |   |   |   |   |
| s |   |   |   |   |   |   |   |   |   |

TABLE V.

|   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|
| n | a | t | v | f | m | m | v | m | o |
| l | i | i | c | e | a | i | i | v | i |
| b | r | i | r | l | d | h | a | i | i |
| i | o | a | i | e | i | s |   | s |   |
|   |   | s | s |   |   |   |   |   |   |

The Use of the Tables is very easy :

For suppose we would compose an Hexameter and Pentameter Verse,

For the Hexameter, chuse any Six of the nine Digits, as suppose 345648, and for the Pentameter, any five of the said nine Digits; as suppose 23479.

First, for the Hexameter take three, the first Figure thereof towards the left Hand, and looking in the first Table, count till you come to the third Square, where you will find the Letter *P* for the first Letter of the first Word; then counting forward till you come to the ninth Place, which falls in the second Column, and second Square, where you will find the Letter *e* for the second Letter of the first Word; and counting forward nine Places more, which falls in the third Column and first Square, where you may find the Letter *s*; and so counting every time, nine Places from the Letter last found, you will have the Word *Pessima*, which is the first Word. Then taking the second Figure 4 in the said Number, and proceeding with it in the second Table, according to the former Directions, you will find the



second Word to be *Bella*; and thus running through the first six Tables with the said six Figures, according to the former Directions, you will find the first Verse to be this that follows;

*Pessima Bella domi monstrabunt verbera nigra.*

And if after this manner you proceed with the other, five Figures in the Table of Pentameters, you will find the other Verse to be,

*Ardua concludunt verba molesta mihi.*

*Note*, If the ninth Place chance to be blank, you may know your Work is finished.

*Note also*, Your Verses may more readily be found thus: Find the first Letter as before, and run the Square diagonally downward towards the left Hand for the remaining Letters: If the Diagonals be too few, the Remainder may be found, by counting nine forward, and running down diagonally as before: So in the first Word before found, I find *Pes*. in the three first Diagonals, and counting nine forward, and looking diagonally, *sima*, which put together makes *Pessima*. And thus of any other.

## Decimal ARITHMETICK.

### NUMERATION.

**W**HAT a Decimal Fraction is, was shewed in the Introduction; but for the Learner's Benefit we shall again repeat it.

A Decimal Fraction is such, whose Denominator is not expressed, but understood, and is an Unit with as many Cyphers annexed, as there are Places in the Numerator. So  $\frac{5}{10}$  will be expressed thus, .5; and  $\frac{25}{100}$  thus, .25; and  $\frac{125}{1000}$  thus, .125; &c.

And

## Numeration In DECIMALS. 165

And they have commonly a Point or Comma prefixed, to distinguish them from an Integer.

*Note,* A Cypher placed to the left Hand of an Integer, or to the right Hand of a Decimal, neither increaseth nor decreaseth the Value; but placed to the right Hand of an Integer, increaseth the Value, and to the left Hand of a Decimal, decreaseth it. *Observe the following Table.*

*The Table of NUMERATION.*

|                |               |           |                 |                |            |           |       |        |              |              |                 |                     |                     |                    |                     |                       |
|----------------|---------------|-----------|-----------------|----------------|------------|-----------|-------|--------|--------------|--------------|-----------------|---------------------|---------------------|--------------------|---------------------|-----------------------|
| Hund. of Mill. | Tens of Mill. | Millions. | Hund. of Thouf. | Tens of Thouf. | Thousands. | Hundreds. | Tens. | Units. | Tenth Parts. | Hund. Parts. | Thousand Parts. | Ten Thousand Parts. | Hund. Thouf. Parts. | Millions of Parts. | Ten Mill. of Parts. | Hund. Mill. of Parts. |
| 9              | 8             | 7         | 6               | 5              | 4          | 3         | 2     | 1      | 2            | 3            | 4               | 5                   | 6                   | 7                  | 8                   | 9                     |
| Integers.      |               |           |                 |                |            |           |       |        | Decimals.    |              |                 |                     |                     |                    |                     |                       |

In this Table you may observe, that as Integers increase in a tenfold Proportion to the left Hand, so Decimal Fractions decrease in a tenfold Proportion to the right Hand.

So  $\left. \begin{array}{r} 5 \\ 50 \\ 500 \\ 5000 \end{array} \right\}$  is  $\left\{ \begin{array}{l} \text{Five} \\ \text{Fifty} \\ \text{Five Hundred} \\ \text{Five Thousand} \end{array} \right.$

And  $\left. \begin{array}{r} .5 \\ .05 \\ .005 \\ .0005 \end{array} \right\}$  is  $\left\{ \begin{array}{l} 5 \text{ Tenth} \\ 5 \text{ Hundred} \\ 5 \text{ Thousand} \\ 5 \text{ Ten Thouf.} \end{array} \right\}$  Parts.

### Reduction in DECIMALS.

By Reduction we find the Decimal of any Fractional Part of Coin, Weight, Measure, &c. And on the contrary, reduce any Decimal Fraction given into its equivalent Fractional Parts of Coin, Weight, Measure, &c.

I

PROP.

## P R O P. I.

Any Vulgar Fraction given, to reduce the same into a Decimal Fraction of equal Value. : To perform which, the Proportion is,

As the Denominator of the Vulgar Fraction given : Is to the Numerator thereof : :

So is an Unit, with Cyphers annexed at Pleasure : To the Decimal Fraction required.

Or thus ;

Add a competent Number of Cyphers to the Numerator, and divide by the Denominator, the Quotient is the Decimal Fraction required.

## E X A M P L E I.

Let it be required to find the Decimal Fraction of  $\frac{3}{4}$ .

*See the Work.*

4.) 3.000 (.75 Facit .75

28

20

20

00

*Note,* The Cyphers added are to be distinguished by a Point or Comma, and you may annex what Number you please ; but you must take notice what Cyphers you make use of ; for so many must be cut off in the Quotient ; and if at any time it happens, as sometimes it will, there be not a sufficient Number in the Quotient, they must be supplied by adding Cyphers to the left Hand.

## E X A M P L E II.

Reduce  $\frac{1}{8}$  into a Decimal.



8) 1.000 (.125 Facit .125

8

20

16

40

40

0

EXAMPLE III.

Reduce  $\frac{35}{721}$  into a Decimal.

721) 35.000000 (.048543

2884

6160

5768

3920

3605

3150

2884

2660

2163

497 Remainder.

In many Cases, as in this Example, though you should annex a thousand Cyphers, yet your Decimal Fraction will not come up, but there will still be a Remainder; but if we bring it five or six Places after the Separatrix, it will be exact enough in most Cases, and the Remainder may be thrown away as of no Value; for if you suppose this was the Fraction of a Pound Sterling, this Decimal will be so near the Truth, as if a Pound were divided into a Million of Parts, it would not err from the Truth so much as one of those Parts.

And

And seeing I made Use of 6 Cyphers in the Operation, and but 5 Figures in the Quotient, I add a Cypher to the Left-hand before I made my separatrix.

## EXAMPLE IV.

Reduce 9 Pence into a Decimal Fraction.

Seeing also 240 Pence make a Pound Sterling, 9 Pence is equal to  $\frac{9}{240}$ , which reduce as before.

240) 9.0000 (.375 the Dec. of 9 d.

720

1800

1680

1200

1200

00

## EXAMPLE V.

Reduce 11 Shillings into a Decimal.

11 Shill. is  $\frac{11}{20}$  20) 11.000 (.55 = to 11 Shill.

100

100

100

00

But the Decimal answering any Number of Shillings, may more quickly be found, by halving the Number of Shillings given.

So for 11 Shill.  $\frac{1}{2}$  of 11 is 5, and 1 remains, 1 Shill. to which suppose a Cypher annexed, makes 10, whose half is 5, as you see, .55 Dec.

So the Decimal of 12 Shillings is .6; of 15 Shillings is .75; of one Shilling is .05; and so of any other.

For if a Pound Sterling be the Integer, it is 20 Shillings; if a Shilling be the Integer, it is 12 Pence; if a Penny be the Integer, it is 4 Farthings. What is the Decimal of 7 Shillings and 6 Pence? The Decimal of 7 Shillings by the last, is .35. Then 6 Pence, which reduced, is .025, to which adding .35, gives .375.

$.35 = 7$  Shillings.  
 $.025 = 6$  Pence.  
 $.375 = 7$  Shillings and 6 Pence.  
But if you consider this, the Decimal of any Number of Pence may be found by taking Parts of the Shilling, of which they consist.

So .05 being the Decimal of 1 Shilling;

$\frac{1}{2} = .025$  is the Decimal of 6 Pence.

And  $\frac{1}{4}$  of the Decimal of 6 Pence, is the Decimal of 3d.

.025 is the Decimal of 6 Pence.

$\frac{1}{4} = .0125$  is the Decimal of 3 Pence.

The 3d Part of the Decimal of 3 Pence, is the Decimal of a Penny, to wit, .004166, and the 4th Part of that, is the Decimal of a Farthing, to wit, .0010416.

$.35 = 7$  Shillings.  
 $.025 = 6$  Pence.  
 $.00025 = 1$  d.  $\frac{1}{4}$ .

So the Dec. of 7s. 7d.  $\frac{1}{4}$  is .38125 = 7s. 7d.  $\frac{1}{4}$ .

In the former Examples of Money, we have supposed the Integer to be a Pound Sterling; but if the Decimal of 6 Pence were required, and the Integer to be a Shilling, then the Decimal would be .5; which if the Integer had been a Pound, would have been the Decimal of 10 Shillings; whereby you may see the Decimal alters according as we take our Integer; so if we account a Penny to be the Integer, the Decimal of 1 Farthing is .25; of 2 Farthings is .5; of 3 Farthings is .75.

And you may see and take notice, that these three last Decimal Fractions are general Fractions in any Case; for .25 is equal to  $\frac{1}{4}$  of any Thing, .5 is equal to  $\frac{1}{2}$  of any Thing, .75 is equal to  $\frac{3}{4}$  of any Thing, as of a Pound, Shilling, Penny, Yard, Hundred, &c.



For if a Pound Sterling be the Integer, .5 is 10 Shillings; if a Shilling be the Integer, .5 is 6 Pence; if a Penny be the Integer, .5 is 2 Farthings; if a Yard be the Integer, .5 is  $\frac{1}{2}$  Yard; and so of any of the rest, which being considered may be of good Use to the Learner.

## EXAMPLE VII.

Let it be required to find the Decimal answering 16 Penny-weights, one Pound Troy being the Integer. Seeing there is 240 Penny-weight in a Pound, 16 Penny-weight is  $\frac{16}{240}$ , which reduced by the Examples foregoing, will be .0666—And so infinitely.

240) 16.00000 (.0666

1440

1600

1440

160

## EXAMPLE VIII.

What is the Decimal of 11 Pen.-wt. 16 Grains?

Bring 11 Pen.-wt. 16 Grains into Grains, which are 280 Grains; then, because there are 5760 Grains in a Pound, 280 Grains will be  $\frac{280}{5760}$ ; but cutting off a Cypher in each, which, reduced as before, will be .048611.

5760) 280.000000 (.048611

23040

49600

46080

35200

34560

6400

5760

6400

5760

EX.

## EXAMPLE IX.

What is the Decimal of 3 Quarters and 14 Pounds, one Hundred, or 112 Pounds, being the Integer? *Ans.* .875.

The Decimal of  $\frac{3}{4}$  is, as was said before, .75, and 14 Pounds is  $\frac{14}{112}$ , which reduced is .125.

$$112) 14.000 (.125$$

112

280

224

560

560

00

Unto .75

Add .125

*Facit* .875

So the Decimal of 2 Pints, 1 Gallon the Integer, will be .25, 45 Minutes of an Hour is .75.

These *Examples* being understood and considered, are sufficient to reduce any other Weights and Measures into Decimals; so we will conclude this *Proposition*.

## PROP. II.

To find the Value of any Decimal Fraction in the known Parts of the Integer, as of *Coin, Weight, Measure*; to perform which, observe the following *Rule*.

## RULE.

Multiply the Decimal given by the Number of Parts of the next inferior Denomination, cutting off as many Figures from the Product as the Decimal given consists of; the Remainder, if any, multiplied by the Parts of the next inferior Denomination, cutting off as before. Thus must you do 'till the Decimal given be brought into its least Parts, the Parts signified by the Decimal, will be thrown over the Separatrix.

Z 2

EX

# Reduction in DECIMALS.

## EXAMPLE I.

What is the Value of .725 of a Pound Sterling?

20 Shillings in a Pound.  
 Shill. 14.500  
 12 Pence in a Shill.  
 Pence 11.250  
 Farthings 3.000  
 Mils 0.000

## EXAMPLE II.

What is the Value of .60875 of a Pound Sterling?

20 Shillings in a Pound.  
 Shill. 12.17500  
 12 Pence in a Shilling.  
 Pence 14.61000  
 Farthings 3.50000  
 Mils 0.00000

Farthings 14.61000  
 Pence 14.61000  
 Shill. 12.17500  
 Pound 0.60875

## EXAMPLE III.

What is the Value of .72065 of a Pound Sterling?

20 Shillings in a Pound.  
 Shill. 14.41300  
 12 Pence in a Shilling.  
 Pence 17.29560  
 Farthings 4.27320  
 Mils 0.00000

Farthings 4.27320  
 Pence 17.29560  
 Shill. 14.41300  
 Pound 0.72065

Note



*Note.* But the Value of any Decimal Fraction of a Pound Sterling may be more easily found thus: For the first Figure after the Separatrix is a double Number of Shillings; if the second Figure be 5, or above, for the 5 account one Shilling more; then the 2d Figure, if under 5, or the Excess, if above 5, added to the 3d, is so many Farthings; remembering to abate 1 from the Farthings, if the Sum be above 13, and 2 from the Farthings, if the Sum be above 40.

## EXAMPLE.

In the Decimal .76565, the first Figure 7 doubled, is 14, which are Shillings; and because the 2d Figure is above 5, subtract 5 from it, and account one Shilling more; and the 15 Farthings are 3 Pence and 3 Farthings: So the Value of it is 15 Shillings and 3 Pence 3 Farthings; as for the rest of the Figures, they being but the Fraction of a Farthing, are inconsiderable in Practice.

So the Value of .6666 of a Pound will be 13 Shillings and 4 Pence. Of .8065 will be 4 Shillings and 3 half Pence; and so of any other.

## EXAMPLE IV.

What is the Value of .625 of a Pound Troy Weight?

|             |                           |
|-------------|---------------------------|
|             | 1250                      |
| Facit 7 Oz. | 625                       |
| 10 Pen. Wt. |                           |
| Ounces      | 7.500                     |
|             | 20 Penny Wt. in an Ounce. |
| Penny Wt.   | 10.000                    |

## EXAMPLE V.

What is the Value of .6725 of a Hundred Weight?

4 Quarters in a Hundred.

Quarters 2.6900

28 Pounds in a Quarter.

55200

13800

Pounds 19.3200

16 Ounces in a Pound.

19200

3200

Ounces 5.1200 Facit 29. 19 lb. 5 oz.

And the Value of .6125 of a Yard, is 1 Foot and 10 Inches. Or .725 of a Gallon, is almost 6 Pints.

But lest these Ways of finding the Decimals of any Parts, as likewise the Value of any Decimal, should seem tedious, we have annexed Tables of the most eminent known Parts of *Money, Weight, Measure, &c.*

The Tables follow.

Decimal

# Decimal TABLES of Coin, Weight and Measure.

TABLE I.

English Coin, one Pound the Integer.

| Shillings | Decimals | Shillings | Decimals |
|-----------|----------|-----------|----------|
| 19        | .95      | 9         | .45      |
| 18        | .9       | 8         | .4       |
| 17        | .85      | 7         | .35      |
| 16        | .8       | 6         | .3       |
| 15        | .75      | 5         | .25      |
| 14        | .7       | 4         | .2       |
| 13        | .65      | 3         | .15      |
| 12        | .6       | 2         | .1       |
| 11        | .55      | 1         | .05      |
| 10        | .5       |           |          |

Pence | Decimals.

|    |         |
|----|---------|
| 11 | .045833 |
| 10 | .041666 |
| 9  | .0375   |
| 8  | .033333 |
| 7  | .029166 |
| 6  | .025    |
| 5  | .020833 |
| 4  | .016666 |
| 3  | .0125   |
| 2  | .008333 |
| 1  | .004166 |

Farth. | Decimals.

|               |          |
|---------------|----------|
| 3             | .003125  |
| 2             | .0020833 |
| 1             | .0010416 |
| $\frac{1}{2}$ | .0005208 |
| $\frac{1}{4}$ | .0002604 |

TABLE II.

English Coin, one Noble the Integer.

Shillings | Decimals

|   |     |
|---|-----|
| 6 | .9  |
| 5 | .75 |
| 4 | .6  |
| 3 | .45 |
| 2 | .3  |
| 1 | .15 |

Pence | Decimals.

|    |       |
|----|-------|
| 11 | .1375 |
| 10 | .1250 |
| 9  | .1125 |
| 8  | .1    |
| 7  | .0857 |
| 6  | .075  |
| 5  | .0625 |
| 4  | .05   |
| 3  | .0375 |
| 2  | .025  |
| 1  | .0125 |

Farth. | Decimals.

|               |           |
|---------------|-----------|
| 3             | .009375   |
| 2             | .00625    |
| 1             | .003125   |
| $\frac{1}{2}$ | .0015625  |
| $\frac{1}{4}$ | .00078125 |

TABLE III.

English Coin, one Shill. long Measure, one Foot the Integer.

Pence. } Decim.  
Inches. }

|    |         |
|----|---------|
| 11 | .916666 |
| 10 | .833333 |
| 9  | .75     |
| 8  | .666666 |
| 7  | .583333 |
| 6  | .5      |
| 5  | .416666 |
| 4  | .333333 |
| 3  | .25     |
| 2  | .166666 |
| 1  | .083333 |

Farthings. } Dec.  
2. Inches. }

|               |          |
|---------------|----------|
| 3             | .0625    |
| 2             | .041666  |
| 1             | .020833  |
| $\frac{1}{2}$ | .010416  |
| $\frac{1}{4}$ | .0052083 |

TABLE IV.

Troy Weight, one Pound the Integer.

Ounces the same as Pence in the last Table.

Pen. wt. | Decim.

|    |         |
|----|---------|
| 19 | .079166 |
| 18 | .075    |
| 17 | .070833 |
| 16 | .066666 |
| 15 | .0635   |



| The rest of the Table. |  | Troy Weight, Oz. the Pound. |  | The rest of the Table. |           |
|------------------------|--|-----------------------------|--|------------------------|-----------|
| 14.058333              |  | Penny-weight, the           |  | Pounds.                | Decimals. |
| 13.054166              |  | Same as Shillings in        |  |                        |           |
| 12.05                  |  | the first Table.            |  |                        |           |
| 11.045833              |  | Grains.                     |  |                        |           |
| 10.041666              |  | Decimals.                   |  |                        |           |
| 9.0375                 |  |                             |  |                        |           |
| 8.033333               |  |                             |  |                        |           |
| 7.029166               |  |                             |  |                        |           |
| 6.025                  |  |                             |  |                        |           |
| 5.020833               |  |                             |  |                        |           |
| 4.016666               |  |                             |  |                        |           |
| 3.0125                 |  |                             |  |                        |           |
| 2.008333               |  |                             |  |                        |           |
| 1.004166               |  |                             |  |                        |           |
| Grains.                |  | Decimals.                   |  |                        |           |
| 23.003993              |  |                             |  |                        |           |
| 22.003819              |  |                             |  |                        |           |
| 21.003646              |  |                             |  |                        |           |
| 20.003472              |  |                             |  |                        |           |
| 19.003298              |  |                             |  |                        |           |
| 18.003125              |  |                             |  |                        |           |
| 17.002951              |  |                             |  |                        |           |
| 16.002778              |  |                             |  |                        |           |
| 15.002604              |  |                             |  |                        |           |
| 14.002431              |  |                             |  |                        |           |
| 13.002257              |  |                             |  |                        |           |
| 12.002083              |  |                             |  |                        |           |
| 11.001910              |  |                             |  |                        |           |
| 10.001736              |  |                             |  |                        |           |
| 9.001562               |  |                             |  |                        |           |
| 8.001389               |  |                             |  |                        |           |
| 7.001215               |  |                             |  |                        |           |
| 6.001042               |  |                             |  |                        |           |
| 5.000868               |  |                             |  |                        |           |
| 4.000694               |  |                             |  |                        |           |
| 3.000521               |  |                             |  |                        |           |
| 2.000347               |  |                             |  |                        |           |
| 1.000173               |  |                             |  |                        |           |
| 1/2.000000             |  |                             |  |                        |           |
|                        |  | TABLE V.                    |  | Ounces.                |           |
|                        |  | Averdupois wt.              |  | Decimals.              |           |
|                        |  | 112 lb. the Integ.          |  |                        |           |
|                        |  | Quarter Hundred             |  |                        |           |
|                        |  | Decimals.                   |  |                        |           |
|                        |  | 3.75                        |  | 15.008370              |           |
|                        |  | 2.5                         |  | 14.007812              |           |
|                        |  | 1.25                        |  | 13.007254              |           |
|                        |  |                             |  | 12.006696              |           |
|                        |  |                             |  | 11.006138              |           |
|                        |  |                             |  | 10.005580              |           |
|                        |  |                             |  | 9.005022               |           |
|                        |  |                             |  | 8.004464               |           |
|                        |  |                             |  | 7.003906               |           |

# Decimal Tables of Coin, Weight, &c. 179

| The rest of the<br>Table.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | The rest of the<br>Table.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | The rest of the<br>Table.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>6.003348</p> <p>5.002790</p> <p>4.002232</p> <p>3.001674</p> <p>2.001116</p> <p>1.000558</p> <p>Quar. Ounc. Decim.</p> <p>3.000418</p> <p>2.000279</p> <p>1.000139</p> <p>Averdupois wt.<br/>1 lb. the Integer.</p> <p>Ounces. Decimals.</p> <p>15.9375</p> <p>14.875</p> <p>13.8125</p> <p>12.75</p> <p>11.6875</p> <p>10.625</p> <p>9.5625</p> <p>8.5</p> <p>7.4375</p> <p>6.375</p> <p>5.3125</p> <p>4.25</p> <p>3.1875</p> <p>2.125</p> <p>1.0625</p> <p>Drams. Decimals.</p> <p>15.058593</p> <p>14.054687</p> <p>13.050781</p> <p>12.046875</p> <p>11.042968</p> | <p>10.039062</p> <p>9.035156</p> <p>8.03125</p> <p>7.027343</p> <p>6.023434</p> <p>5.019531</p> <p>4.015625</p> <p>3.011718</p> <p>2.007812</p> <p>1.003906</p> <p>TABLE VI.</p> <p>Liquid Measure,<br/>one Gallon; dry<br/>Measure, one qr.<br/>the Integer.</p> <p>Pints. Dec. Bush.</p> <p>7.875</p> <p>6.75</p> <p>5.625</p> <p>4.5</p> <p>3.375</p> <p>2.25</p> <p>1.125</p> <p>qr. Pts. D. Pcks.</p> <p>3.09375</p> <p>2.0625</p> <p>1.03125</p> <p>Decim. qr. Pcks.</p> <p>0.234375</p> <p>0.15625</p> <p>0.078125</p> | <p>Decimals. Pints.</p> <p>0.05859</p> <p>0.03906</p> <p>0.01953</p> <p>TABLE VII.</p> <p>Time; One Year<br/>the Integer.</p> <p>Months, the same<br/>as Pence in the<br/>third Table.</p> <p>Days. Decimals.</p> <p>30.082191</p> <p>29.079452</p> <p>28.076712</p> <p>27.073972</p> <p>26.071233</p> <p>25.068493</p> <p>24.065753</p> <p>23.063014</p> <p>22.060274</p> <p>21.057534</p> <p>20.054794</p> <p>19.052055</p> <p>18.049315</p> <p>17.046575</p> <p>16.043836</p> <p>15.041096</p> <p>14.038356</p> <p>13.035616</p> <p>12.032876</p> <p>11.030137</p> <p>10.027397</p> |

186 *Decimal Tables of Coin, Weight, &c.*

| <i>The rest of the Table.</i>                                                                                                                                                                                                                                                                                                                                                                                                                                         | <i>The rest of the Table.</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <i>The rest of the Table.</i>                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>9 .024657</p> <p>8 .021917</p> <p>7 .019178</p> <p>6 .016438</p> <p>5 .013698</p> <p>4 .010959</p> <p>3 .008219</p> <p>2 .005479</p> <p>1 .002739</p>                                                                                                                                                                                                                                                                                                              | <p><i>Minutes   Decim.</i></p> <p>59 .040972</p> <p>58 .040577</p> <p>57 .039583</p> <p>56 .038888</p> <p>55 .038194</p> <p>54 .0375</p> <p>53 .036805</p> <p>52 .036111</p> <p>51 .035416</p> <p>50 .034722</p> <p>49 .034027</p> <p>48 .033333</p> <p>47 .032638</p> <p>46 .031944</p> <p>45 .03125</p> <p>44 .030555</p> <p>43 .029861</p> <p>42 .029166</p> <p>41 .028472</p> <p>40 .027777</p> <p>39 .027083</p> <p>38 .026388</p> <p>37 .025694</p> <p>36 .025</p> <p>35 .024305</p> <p>34 .023611</p> <p>33 .022916</p> <p>32 .022222</p> <p>31 .021527</p> <p>30 .020833</p> <p>29 .020138</p> <p>28 .019444</p> <p>27 .01875</p> <p>26 .018055</p> <p>25 .017361</p> <p>24 .016666</p> | <p>23 .015972</p> <p>22 .015277</p> <p>21 .014583</p> <p>20 .013888</p> <p>19 .013194</p> <p>18 .0125</p> <p>17 .011805</p> <p>16 .011111</p> <p>15 .010416</p> <p>14 .009722</p> <p>13 .009027</p> <p>12 .008333</p> <p>11 .007638</p> <p>10 .006944</p> <p>9 .00625</p> <p>8 .005555</p> <p>7 .004861</p> <p>6 .004166</p> <p>5 .003472</p> <p>4 .002777</p> <p>3 .002083</p> <p>2 .001388</p> <p>1 .000694</p> |
| <p><i>Time; One Day the Integer.</i></p> <p><i>Hours.   Decimals.</i></p> <p>23 .958333</p> <p>22 .916666</p> <p>21 .875</p> <p>20 .833333</p> <p>19 .791666</p> <p>18 .75</p> <p>17 .708333</p> <p>16 .666666</p> <p>15 .625</p> <p>14 .583333</p> <p>13 .541666</p> <p>12 .5</p> <p>11 .458333</p> <p>10 .416666</p> <p>9 .375</p> <p>8 .333333</p> <p>7 .291666</p> <p>6 .25</p> <p>5 .208333</p> <p>4 .166666</p> <p>3 .125</p> <p>2 .083333</p> <p>1 .041666</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p><b>TABLE VII.</b></p> <p><i>Cloth Measure, One Yard the Integer.</i></p> <p><i>Quarters   Decim.</i></p> <p>3 .75</p> <p>2 .5</p> <p>1 .25</p> <p><i>Nails.   Decimals.</i></p> <p>3 .1875</p> <p>2 .125</p> <p>1 .0625</p>                                                                                                                                                                                    |



(181) *The Use of the Tables.*

Concerning the Construction of these Tables, we need to say nothing, that being sufficiently shewn in the first nine Examples of this Rule, but proceed to their Use in a Proposition or two, and so conclude this Rule.

**PROP. I.**

To find the Decimal answering any Fractional Part of Coin, Weight, Measure, &c.

This is for the most Part given by Inspection, or at most by a single Addition of two or three Numbers.

**EXAMPLE I.**

What is the Decimal answering 17 Shill. 1<sup>l</sup>. being the Integer?

Seek in the first Table for 17 Shillings, in the Table of Shillings, and against it in the Column adjoining is .85; the Decimal required: So the Decimal of 5 Shillings, one Noble being the Integer, by the second Table is found to be .75; and the Decimal of 8 Pence, one Shilling being the Integer, by the third Table is .666666; which is likewise the Decimal of 8 Inches, or 8 Months, a Foot being the Integer in the one, and a Year in the other; likewise the Decimal of 21 Pounds by the fifth Table, 112 *lb.* being the Integer, will be .1875; and so of any other.

**EXAMPLE II.**

What is the Decimal answering 7 *s.* 9 *d.* 1 *q.* a Pound Sterling being the Integer?

By the first Table  $\left\{ \begin{array}{l} 7 \text{ Shillings is } .35 \\ 9 \text{ Pence is } .9375 \\ 1 \text{ Farthing is } .001041 \end{array} \right.$

The Decimal of 7 *s.* 9 *d.* 1 *q.* is  $\underline{.388541}$

So the Decimal of 3 *qr.* 7 *lb.* 8 *oz.* by the fifth Table, will be found to be .816964.

For the Decimal of 3 Quarters is .75  
of 7 Pound is .0625  
of 8 Ounces is  $\underline{.004464}$

of 3 *qr.* 7 *lb.* 8 *oz.* is  
A a 2

$\underline{.816964}$   
After

After the same manner the Decimal of 3 s. 9 d., a Noble the Integer, by the second Table, will be found to be .5925; and so of any other.

The second Table was added, because some may dislike the first Table, in respect some Parts of Coin will not be exactly expressed in Decimals by it, and though infinitely near the Truth, yet will never equal it.

But if you make a Noble the Integer, you may express any Parts exactly by it, as may be seen by the Table itself.

### PROPOSITION II.

Any Decimal Fraction of Coin, Weight, or Measure, being given, to find the Value thereof.

This is but the Converse of the last Proposition, and he that understands that, cannot be ignorant of this; however take an Example or two.

**EXAMPLE I.** Let .65 be the Decimal Fraction of a Pound Sterling, and let the Value thereof be required.

Seek in the first Table of *English Coin* for .65, and in the Column of Shillings over-against it I find 13 Shillings, the Value of the Decimal given. So .75 Parts of a Pound Sterling will be found to be 15 Shill. but if the Integer had been a Hundred Weight, the Value thereof by the fifth Table, will be found to be  $\frac{3}{4}$ , or 3 Quarters.

Likewise .049315, being the Decimal of a Year, by Table the 7th, will be found to be 18 Days.

### EXAMPLE II.

But sometimes your Decimal given cannot be found at one time, then use the following Method.

So if the Value of .46725 of a Pound Troy were required.

Seek in the fourth Table; and because therein the Ounces are not expressed, because they are the same as Pence; in the third Table find the Ounces there, and the Penny-weight and Grains in the fourth Table, and the Value will be found to be 5 Ounces, 12 Penny-weight, and 3 Grains.

*See the following Work.*

The

The Remainder being less than a Grain, is inconsiderable, and so not taken notice of.

Decimal given 146725  
Nearest .41666 = 5 Ounces.

Remainder .05059  
Nearest .05 = 12 Pen. wt.

Remainder .00059  
Nearest .00052 = 3 Grains.

So if the Value of .77777 of a Hundred Weight were sought, it would be found to be 3 gr. 3 lb. 1 oz.  $\frac{3}{4}$ .

See the Work.

Decimal given .77777  
Nearest less .75 = 3 Quarters.

Remainder .02777  
Nearest less .02678 = 3 Pound.

Remainder .00099  
Nearest less .00055 = 1 Ounce.

Remainder .00044  
Nearest less .00041 = 3 Qr. Ounce.

3 Neglect.

And so of any other.

It remains only we should say something of the third Table, and so conclude.

This Table is of excellent Use, being not only a Decimal Table of Pence, 1 Shilling being the Integer, but likewise of Inches, Months, Dozens, or any other Weight or Measure where the Integer is divided into 12 Parts: It will likewise give the Decimal of any Pence or Farthings, supposing a Pound Sterling were the Integer; for if to the Decimal of any Number of Pence in the Table, you prefix a Cypher, and take  $\frac{1}{2}$  that Number, it shall be the Decimal of the same Number of Pence, a Pound being the Integer.

So if the Decimal of 7 Pence were required, and a Pound the Integer, it would be found to be .029166.

The Decimal of 7 Pence in the Table, .583333

1-5. the Integer

The same with a Cypher prefixed is .0583333

One half of the last is the Answer = .0291666 = 7 d.



And that this is the Decimal of  $7d.$  may be proved by the first Table.

The Use of this Table being so excellent, it ought by every Learner to be got by Heart, which is easy to do, by reading the Numbers as are expressed underneath.

For  $11d.$  Read, Nine, One and all Sixes.

10—Eight and all Threes.

9—Seven, Five.

8—All Sixes.

7—Five, Eight, and all Threes.

6—Five.

5—Four, One, and all Sixes.

4—All Threes.

3—Two, Five.

2—One, and all Sixes.

1—Nought, Eight, and all Threes.

### Addition of DECIMALS.

**A**DDITION of Decimals is not much different from Addition of Integers, only you must take care to keep Units under Units in Integers, and Tenths under Tenths in Decimal Parts.

#### EXAMPLE I.

Let it be required to add  $.7125$  of a Pound to  $.42$  of a Pound. The Sum is  $1.1325$  or  $1\text{L } 2\text{s. } 7\text{d. } 3\text{q. } \frac{1}{2}$ .

Place your Numbers thus  $.7125$  Not thus  $.7125$

$.42$

$.42$

And the Sum will be  $1.1325$

Not  $.7167$

*Note,* When you have added your Decimals together, so many must be cut off with a Dash of your Pen, as that Decimal Number consists of, which in your Example contains the most Places; the rest, if any, are Integers; as may be seen in the Examples.

So

## Addition of DECIMALS. 189

So the Sum of  $\left. \begin{array}{r} .7426 \\ .846 \\ 7.612 \\ 5.5 \end{array} \right\}$  is 14.7006

Let it be required to be placed thus:

$$\begin{array}{r} .7426 \\ .846 \\ 7.612 \\ 5.5 \\ \hline \text{Sum } 14.7006 \end{array}$$

The Remainder is —

$$\begin{array}{r} 421.625 \\ 46.1625 \\ 5.21925 \\ .416786 \\ \hline 6618.1 \\ 24424.712 \\ \hline \text{Will be } 31591.035536 \end{array}$$

And the Sum of

But if your Numbers given to be added are not all of the same Denomination, they must be brought into Fractions of like Denominations, as in the following Example is done.

Let it be required to add .725 of a Pound, and .625 of a Shilling, into one Sum.

First, Find what Decimal of a Pound .625 will represent, which is easily done if you prefix a Cypher, for then half the Number is the Decimal of a Pound.

The Number with a Cypher prefixed, is .0625,  $\frac{1}{2}$  is .03125.

Then add  $\left\{ \begin{array}{r} .725 \\ .03125 \end{array} \right\}$  Sic de cæteris.

The Sum is .75625

## Subtraction in DECIMALS.

Subtraction in Decimals differs but little from Subtraction in Integers, only in placing your Numbers you must, as in Addition, keep Units under Units in Integers, and Tenths under Tenths in Decimal Parts.

E X.

## EXAMPLE.

Let it be required to subtract .617 from .84125, which are to be placed thus:

$$\begin{array}{r} \text{From } .84125 \\ \text{Subt. } .617 \\ \hline \end{array}$$

The Remainder is = .22425

So if from 25.75  
You subtract 6.9845

There will remain 18.7655

If the Decimal Parts in either Number have fewer Places than the other, the Vacancy is to be supplied by annexing so many Cyphers as will make them equal, or supposing them to be annexed. As here,

Cyphers annexed

From 426.4500

Sub. 129.6925

Cyphers supposed annexed

From 426.45

Sub. 129.6925

Reft 296.7575

The Remainder 296.7575

But if your Numbers given to be subtracted are not of the same Denomination, you must, as in Addition, bring them into one Denomination, as in the following Example.

Let it be required to subtract .03125 of an Ounce Troy, from .0625 of a Pound Troy.

Seeing one is the Decimal of an Ounce, and the other the Decimal of a Pound, bring them both into the Decimal of a Pound, by dividing .03125 the Decimal of an Ounce, by 12 of the Ounces in a Pound, and it will give .002604.

$$\begin{array}{r} .03125 \\ \times 12 \\ \hline .002604 \end{array}$$

Then From .0625  
Sub. .002604

Reft .059896 = 14 : 8  
Or you may bring them both into the Decimal of an Ounce by multiplying .0625 the Decimal of a Pound, by 12 the Ounces in a Pound, which is the Converse of the last,



## Multiplication in DECIMALS. 187

last, and it will give .7500 or .75, both being the same.

$$\begin{array}{r}
 .0625 \\
 12 \\
 \hline
 .7500
 \end{array}
 \quad
 \begin{array}{l}
 \text{Then } \left\{ \begin{array}{l} \text{From } .75 \\ \text{Subt. } .03125 \end{array} \right. \\
 \hline
 \text{Rest. } .71875 = 14 : 8
 \end{array}
 \quad
 \begin{array}{l}
 \text{ptw. gr.} \\
 14 : 8
 \end{array}$$

And so of any other.

## Multiplication in DECIMALS.

1. *Multiplication in Decimals*, both in placing your Figures, and in the Work itself, differs nothing at all from Multiplication of Integers, only when your Work is finished, you must take care that with a Dash of your Pen you make as many Places of Decimals in your Product, as there are Places of Decimals both in your Multiplier and Multiplicand ; but in case of want in your Product, annex Cyphers to the Left-hand.

2. In Multiplication of Decimals, it will be convenient to make that Number the Multiplicand which contains most Places, though sometimes it may be less in Quantity. And *Note*, That if both Terms to be multiplied, be Decimals, the Product will be a Decimal ; or if both be mix'd, that is, if both Terms consist both of Integers and Decimals, the Product will be mix'd : but if one be mix'd and the other a Decimal, the Product will sometimes be mix'd, sometimes a Decimal.

### EXAMPLE I.

Let it be required to multiply .75 by .425, the Product will be found to be .31875.

Mul. .425 Multiplicand.  
By .75 Multiplier.

$$\begin{array}{r}
 2125 \\
 2975 \\
 \hline
 \text{Facit } .31875
 \end{array}$$

B L

EX-

188 *Multiplication in DECIMALS.*

*E X A M P L E II.*

The Length of a Board is seven Foot .615 Parts.

The Breadth of the Board is one Foot .15 Parts.

What is the Superficial Content?

*Facit* 8.75725, or 8 Foot  $\frac{3}{4}$ .

Mul. 7.615 Multiplicand.

By 1.15 Multiplier.

$$\begin{array}{r} 38075 \\ 7615 \\ 7615 \\ \hline \end{array}$$

*Facit* 8.75725 the Product.

*E X A M P L E III.*

Let it be required to multiply 2 Shill. 6 Pence by 2 Shill. 6 Pence, 1 Pound being supposed to be the Integer.

The Decimal answering 2 s. 6 d. or  $\frac{1}{4}$  of a Pound is .125

Then 1 Mul. .125 Multiplicand.

By the same .125 Multiplier.

$$\begin{array}{r} 625 \\ 250 \\ 125 \\ \hline \end{array}$$

*l. s. d. q.*

*Facit* .015625 = 00 00 3 3

The same Question performed by Vulgar Fractions.

Mul.  $\frac{1}{8}$  of a Pound

By  $\frac{1}{8}$  of a Pound.

*d. q.*

*Facit*  $\frac{1}{64}$  of a Pound = 3 3.

The Value of  $\frac{1}{84}$  of a Pound, by the 4th Note, in Reduction of Vulgar Fractions, is equal to 3 d. 3 q. as before; or if you reduce  $\frac{1}{84}$  into a Decimal by Proposition the first, in *Reduction of Decimals*, the Decimal will be the same as in the former Work, which may be a Proof of the Question.

Think it not strange that 2 s. 6 d. multiplied by 2 s. 6 d. produceth but 3 d. 3 q. but you must understand that Fractions

## Multiplication in DECIMALS. 189

Fractions multiplied together become less in the same Proportion as Integers by multiplying become greater.

Some of our Pretenders to Art deny this; but for the Benefit of the young Learner, and to stop the others Mouths, we shall give you a Demonstration thereof by the First of the Second of *Euclid*.

Any two Numbers being to be multiplied together, if you divide either or both into as many Parts as you please; if then you multiply those Parts one by another, the Sum of those Products will be equal to the Product of one Number multiplied by another.

Let us divide the former Numbers, one into two Parts, and the other into three Parts:

First, Let us divide one into 1 s. and 1 s. and 6 d. and the other into 2 s. and into 6 d. then multiply those Parts one by another as followeth.

First, 6 d. by 6 d. or .025 by .025 is = .000625

Secondly, 1 s. by 6 d. or .05 by .025 is = .00125

Thirdly, 1 s. by 6 d. or .05 by .025 is = .00125

Fourthly, 6 d. by 2 s. or .025 by .1 is = .0025

Fifthly, 1 s. by 2 s. or .05 by .1 is = .005

Sixthly, 1 s. by 2 s. or .05 by .1 is = .005

Products

Sum of the Products = .015625

Which Product is the same as was found by the Multiplication of the two Numbers before, which shews the Work to be right.

But suppose the former Question were propounded, and a Shilling to be the Integer, then the Work would have been as underneath, and the Product would be 6.25 or 6 s. 3 d.

*See the Work.*

2.5

2.5

125

50

Facit 6.25

Thus you may see your Product will alter in Value, according as you alter your Integer.

B b 2

E X-



# 180 . Multiplication in DECIMALS.

## EXAMPLE IV.

Let it be required to multiply 54. 125. 9 d. by 34. 65. 3 d.

Decimal answering 125. 9 is .6375

And of 65. 3 is .3125

Then Multiply 5.6375

By 3.3125

281875

112750

56375

169125

169125

The Product 18.67421875 = 18 : 13 : 5 : 3 1/2

But seeing we have for the most part, but Occasion for three or four Figures after the Separatrix, and sometimes the Multiplications are tedious and long ; we will therefore give you a Rule how you may contract your Work, and yet secure what Places of Decimals you please. To do which, observe the following Method.

Having set down your Multiplicand as usual, set the Units Place of your Multiplier under that Figure in your Multiplicand, which stands as far from Unity as the last Figure of your Product is desired to stand, and write the rest in the Inverse Order ; then multiply by your Multiplier, as usual ; only Note, That you need only begin in your Multiplicand, with that Figure that stands over the Figure you multiply by ; having a respect to the Increase that would come from the following Figures of the Multiplicand, placing every single Product exactly even at the Right-hand, contrary to the common Way, and adding them as they stand, you must cut off so many Figures in your Product as was designed, which you may better understand by the Work of the following Example.

See the last Question wrought, and but three Figures cut off.

Multi-

## Division in DECIMALS. 191

Here you may see the Work contracted much, and the Product to three Places as was before.

So if .125 were to be multiplied by .125, as in the third Example beforegoing, and to have four Figures of Decimals after the Separatrix.

Here because there was but three Places, I prefix a Cypher, and the Product to four Places is the same as before.

When a Decimal Fraction or mixed Number is to be multiplied by an Unit with Cyphers (as 10, 100, 1000, &c.) you need only to remove the Separatrix so many Places towards the Right-hand as there are Cyphers annexed to the Unit. So if .1278 were to be multiplied.

$$\text{By } \left\{ \begin{array}{l} 10 \\ 100 \\ 1000 \\ 10000 \end{array} \right\} \text{The Product will be } \left\{ \begin{array}{l} 1.278 \\ 12.78 \\ 127.8 \\ 1278 \end{array} \right.$$

## Division in DECIMALS.

Division in Decimals differs nothing from Division of Integers, either in placing the Numbers, or in the Work itself: All the Difficulty being in discovering the true Value of the Quotient; which to do, observe the following Rule, which is but the Converse of that in Multiplication, and is this that follows.

I

As

As many Figures as are cut off in the Dividend, so many must be cut off in the Divisor and Quotient; or thus, So many Figures must be cut off in the Quotient, as will make those, cut off in the Divisor, equal to those in the Dividend; taking notice if there be not so many in the Quotient, you must add Cyphers to the Left-hand. *Note also*, If your Dividend be an Integer, or have less cut off than is in the Divisor, it is convenient you add Cyphers to the Dividend, 'till they be equal or more; then the Work will be easy.

The following Example will make all plain.

### EXAMPLE I.

Where the Dividend is a mixt Number, and the Divisor an Integer. Divide 742.651 by 41.

*See the Work.*      l.   s.   d.

$$41) 742.651 \quad (18.113 = 18 : 2 : 3 : \frac{1}{2}$$

41 ····

332

328

46

41

55

41

141

123

The Quotient  
is 18.113

18

### EXAMPLE II.

Where both are mixt Numbers.

Divide 4672.565, by 25.635.

*See the Work.*

In



# *Division in DECIMALS.*

193

25.635) 4672.565 (182

In this Example, because there is alike cut off in both, the Quotient is an Integer. And with adding of Cyphers, you must bring it as far after the Separatrix as you please.

25635

210906

205080

58265

51270

6995 Remainder.

## *EXAMPLE III.*

Where both Numbers are Decimals, divide .75 by .0125.

Seeing I cannot divide, I add Cyphers to the Dividend, to wit, two, and there will be alike cut off in both; then, as in the last Example, the Quotient will be an Integer.

*See the Work.*

.0125) .7500 (60

750

00

*Facit 60 in the Quotient.*

By which you may observe, That as Multiplication of Fractions decreaseth their Value, so Division of Fractions increaseth the Value contrary in both to the Nature of Integers.

This last Example is the same as if it were demanded to divide 15 Shill. by 3 Pence, the Quotient will be found to be 60 Pounds. The Proof is easy by Multiplication.

For if we multiply 3 *d.* or .0125 by 60 *l.* the Quotient will be .75 or 15 Shill. as you may see by the Work.

.0125

60

.7500 = 15 Shill.

Supposing still a Pound Sterling to be the Integer.

*EX-*

## EXAMPLE IV.

Where the Dividend is an Integer, and the Divisor a Decimal, let it be required to divide 1425, by .6252.

Here before Division can be well made, it will be convenient to add a competent Number of Cyphers.)

If you only require the Integral Part of the Quotient, add so many Cyphers to the Dividend as there are Decimal Parts in your Divisor, then your Quotient will be wholly Integral; but if you require Decimal Parts, so many Cyphers more must be added (besides the Number to make them equal) as you design to have Decimal Parts in your Quotient.

Let us in this Question have three Places of Decimals after the Integral Part of the Quotient, which will be 2279.270.

*See the Work.*

.6252) 1425.0000000 (2279.270

12504

17460

12504

49560

43764

57960

56268

16920

12504

44160

43764

396 Remainder.

## EXAMPLE V.

Where the Dividend is a Decimal, and the Divisor an Integer. Let us divide .13975, by 43.

*See*

# Division in DECIMALS.

195

When the Division was finished, 43) 13975 (-00815 there were but 3 Figures in my Quotient; and seeing there should be 5 cut off, I therefore annex two Cyphers to the Left-hand, as may be seen in the Example.

And if 529125 were divided by 425, the Quotient would be 1245.

See the Work.

$$425 \overline{) 529125} \quad 1245$$

What Division is that, by which dividing 525, shall give a Quotient equal to the Product the same Number multiplied by 125? What. 425.

$$425 \overline{) 104375} \quad 245$$

$$425 \overline{) 85000} \quad 200$$

$$425 \overline{) 19125} \quad 45$$

$$425 \overline{) 1900} \quad 4$$

$$425 \overline{) 2125} \quad 5$$

$$425 \overline{) 2125} \quad 5$$

$$425 \overline{) 0} \quad 0$$

When any Decimal Fraction or mixt Number is to be divided by an Unit with any Number of Cyphers annexed, it is but removing the Separatrix so many Places towards the Left-hand, as there were Cyphers annexed to the Unit.

So if 17.28 were given to be divided

$$\text{By } \left\{ \begin{array}{l} 10000 \\ 1000 \\ 100 \\ 10 \end{array} \right\} \text{ The Quotient will be } \left\{ \begin{array}{l} 1.728 \\ .1728 \\ .01728 \\ .001728 \end{array} \right.$$

By what goeth before, it may be observed, that if the Dividend be greater than the Divisor, the Quotient will be either

C c



either be an Integer, or a mixt Number; but if the Divisor be greater, the Quotient will be a Decimal.

Multiplication and Division in Decimals (as in Integers) interchangeably prove each other.

To prove Multiplication, divide the Product by the Multiplier, quotes the Multiplicand; or by the Multiplicand, quotes the Multiplier.

To prove Division, multiply the Quotient by the Divisor, produceth the Dividend.

Before we leave Division in Decimals, we will give the Learner the Resolution of two excellent Problems, which will be of good Use.

The first is, having a Multiplier, to find a Divisor.

Divide an Unit with Cyphers by the Multiplier, the Quotient will be the Divisor sought.

*E. X. A. M. P. L. E.*

What Divisor is that, by which dividing 7315, shall give a Quotient equal to the Product of the same Number, multiplied by 125? *Facit.* 008. — *See the Work.*

$$\begin{array}{r} 125 \overline{) 1.000} \cdot 008 \\ 1.000 \\ \hline \end{array}$$

*The P R O O F.*

|                                                                                                        |                                                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $\begin{array}{r} 7315 \\ 125 \overline{) 7315} \\ \hline 36575 \\ 14630 \\ \hline 914375 \end{array}$ | $\begin{array}{r} \cdot 008 \overline{) 7315.000} \quad (914375) \\ 2512 \\ 2512 \\ \hline 72 \\ \hline 11 \\ \hline 8 \\ \hline 35 \\ \hline 32 \\ \hline 30 \end{array}$ |
|--------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Here you may see the Product and the Quotient are the same.

|                                                                                                            |                                                                                 |
|------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| $\left. \begin{array}{l} 1.728 \\ 8 \\ 0.1728 \\ 0.01728 \end{array} \right\} \text{The Quotient will be}$ | $\left. \begin{array}{l} 240 \\ 100 \\ 60 \\ 25 \end{array} \right\} \text{By}$ |
|------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|

By what is said before, it may be observed, that if the Dividend be greater than the Divisor, the Quotient will be an Integer, or a mixt Number; but if the Divisor be greater, the Quotient will be a Decimal.

The

## Golden Rule in DECIMALS. 897

The second is, having a Divisor, to find a Multiplier.

This is but the Converse of the former; for if you divide Unity with Cyphers annexed by the given Divisor, the Quotient will be the Multiplier sought.

### E X A M P L E.

What Multiplier is that by which multiplying 7315, shall give a Product equal to the Quotient of the same Number, divided by .008? *Facit 125.*

*See the Work.*

.008) 1.000 (125

8

20

16

40

40

0

The Proof is in the last.

— 22 —

## Golden Rule in DECIMALS.

We shall not in this Place need to give you a Definition of the Rule of Three; that being sufficiently done in *Vulgar Arithmetick*.

For seeing the Rule of Three in Decimals is the same, both in the stating and working of the Question, as in the Rule of Three before taught, respect being had to the Rules in Decimals aforegoing, which if well understood, any Question of the Golden Rule, though consisting of never so cross Fractional Parts, will receive its Resolution as easily as if the Question were composed of Integers only, which shall be made plain in the following Examples.

### Q U E S T. I.

If 7 Yards and Three Quarters of Cloth cost 2*l.* 12*s.* 9*d.* what will 140 Yards and an half of the same Cloth cost?

The Fractional Parts reduced to Decimals by the Rules aforegoing, and stated as taught in the Rule of Three in *Vulgar Arithmetick*, the Work will stand as follows.

C c 2.

If

If 7.75 : 2.6375 :: 140.5

140.5

131875

105500

26375

7.75) 275.61875 (35.563

2325

4311

3875

4368

3875

4937

4650

2875

2325

330

QUEST. II.

If a Chest of Sugar weighing 7 C. 2 gr. 14 lb. cost 36l. 12s. 9d. What will 2 C. 1 gr. 21 lb. of the same Sugar cost?

The Fractional Parts reduced into Decimals, and stated as before taught, the Work will stand as underneath.

C. lb.

C.

If 7.626 : 36.6375 :: 2.4375

2.4375

1831875

2564625

1099125

1465500

732750

Ans. 11 l. 14 s. 2 d. 1 q.

7.626) 89.30390625 (11.71045

Remainder 1435

QUEST.

29



QUEST. III.

A Grocer buys 24 Tuns, 12 Hundred, 2 Quarters, 12 Pounds, and 12 Ounces of Tobacco, for 3678 Pounds, 6 Shillings, and 4 Pence; What will one Ounce of this Tobacco cost?

The Question reduced and stated, will stand thus as beneath.

$$\begin{array}{rcc} & \text{G.} & \text{lb.} & \text{C.} \\ \text{If } 492.6316 : 3678.3166 :: .000558 \\ & & .000558 & \end{array}$$

$$492.6316) 2.0525007 (.00416$$

The Work at large is neglected, only the Product } Answer 1 d. the Ounce, ferè.  
and Quotient.

QUEST. IV.

If 16 Pioneers make a Trench in one Month and 14 Days, How many Pioneers will make the same Trench in 12 Days? *Answ.* 56 Pioneers; 28 Days to the Month.

See the Work.

$$\begin{array}{rcc} \text{M.} & \text{P.} & \text{M.} \\ \text{If } 1.5 : 16 :: .42857 & \text{In my Product, because I} & \\ & \text{had but one Decimal Place, I} & \\ & \text{annexed 4 Cyphers, to equal} & \\ & \text{the Number of Decimal Places} & \\ & \text{in my Divisor, that so my Quo-} & \\ & \text{tient might be an Integer.} & \end{array}$$

$$\begin{array}{r} .42857) 24.00000 (56 \\ \underline{214285} \end{array}$$

*Note, This and the two next Questions, are done by the Reverse Rule.*

$$\begin{array}{r} 257150 \\ 257142 \\ \hline 8 \end{array}$$

QUEST. V.

If when Wheat is sold for 12 Shillings the Quarter, the Half-penny White Loaf ought to weigh one Pound, one Ounce, and 12 Penny-Weight; What must the Half-penny

penny White-Loaf weigh, when Wheat is sold for 1 Pound 16 Shillings, and 3 Pence the Quarter? *Answer*, The Half-penny White-Loaf ought to weigh 4 Ounces and 10 Penny-Weight.

*1.* *lb.* *1.* *dw.*  
If .6 : 1.1333 :: 1.8123

.6 3 dw.  
1.8125 .68000 (.3751 = 4 : 10

54375

136250

126875

93750

90625

31250

### QUEST. VI.

What Length of a Board 9 Inches broad will make a square Foot, when 12 times 12, or 144 Inches, make one Foot? Say, if 12 in Breadth require 12 in Length, what will 9 in Breadth require? *Ans.* 16 Inches in Length.

*See the Work.*

*B. L. B.*

If 12 : 12 :: 9

12

9) 144 (16

9

54

54

0

### Double Golden Rule in DECIMALS.

We shall here give you an Example or two in the Double Rule of Three in Decimals, or Rule of Plural Proportion, and to conclude this Rule.

QUEST.

# Double Golden Rule in DECIMALS. 201

## QUEST. I.

If three Labourers in two Months and twelve Days thrash 221 Quarters, three Bushels, and two Pecks of Corn, how much will nine Labourers thrash in one Month, two Weeks, and five Days?

Lab.      Quar.      Lab.

First say, If 3 thrash 221.4375, what will 9 thrash?

Quar.

Facit 664.3125.

Say again, If 2.42857 Months thrash 664.3125 Quart. what will 1.67857 Months thrash? Facit 459.156 equal to 459 Quarters, one Bushel, and one Peck.

## QUEST. II.

Mr. Bridges, in his *Lex Mercatoria*, Page 222, hath the following Question.

If 100 *l.* in 12 Months gain 8 *l.* what will 7390 *l.* in 13 *mo.* 3 *q.* gain in 9 Months? And further saith, the most methodical Way of working this Question will require about 360 Figures more than the practical Way, he shews in the Work of the said Question, p. 188 of the said Book, which we will examine.

First, I say, If 100 : 8 :: 7390.699

8

Facit 591.25592 = one Year's Gain.

M. l.

M.

Say again, If 12 : 591.25592 :: 9

9

5321.30328

5321.30328 = 443 *l.* 8 *s.* 10 *d.* the *Ans.*

Here is but about 40 Figures besides the *Answer*, taking in the stating of the Question, and all which we might have contracted to much fewer; and his Practical Way, before mentioned, hath above 60 Figures besides the *Answer*; and how he will find a more methodical Way I know not.

Mr. Bridges had no Reason to undervalue Decimal Arithmetick so much, if he had notice thereof; it and the Logarithms being two of the most famous Inventions the preceding



## 202 Double Golden Rule in DECIMALS.

ceding Ages have been Masters of; and if we use the Practical Way, it is convenient the Fractional Parts be reduced into Decimals, as in the annexed Operation is manifest.

First, I multiply by 8, cutting off 5 Fig. viz. 3 for the Decimal, and 2 instead of dividing by 100; that done, I took half for six Months, and half of six Months for Months, which two Numbers added, make 443<sup>7</sup>/<sub>8</sub>. 8. to 4. as before.

7396.699

8

591.25592

295.6279

147.8139

443.4418

443<sup>7</sup>/<sub>8</sub>. 8. 104

### QUEST. III.

If 2 Angels be equal to 20 Shillings, and 15 Shillings equal to 3 Crowns, and 60 Crowns equal to 15 Pounds, and 13 Pounds equal to 12 Guineas; how many Angels will countervail 650 Guineas?

1. Ang. 1.

First, I say, If 20 : 2 :: 15 : Facit 1.5 Angels.

Crown. Ang. Crown.

Secondly, If 3 : 1.5 :: 60 : Facit 30 Angels.

1. Ang. 1.

Thirdly, If 15 : 30 :: 13 : Facit 26 Angels.

Guin. Ang. Guin.

Lastly, If 12 : 26 :: 650 : Facit 1408.333 Angels.

Answer. 1408.333 Ang. or, 1408 Ang. 3 Shill. and 4 Pence.

The last Question may be wrought by Division only, by placing your Numbers as underneath.

Here if you  
multip. the 1st,  
3d, 5th, 7th, and  
9th for a Divi-  
dend; and the  
2d, 4th, 6th, and  
8th for a Divi-  
sor, the Quoti-  
ent is the An-  
swer, which you  
may try at your  
Leisure.

### THUS,

If 2 Angels equal 20 Shillings,  
And 15 Shillings equal 3 Crowns,  
And 60 Crowns equal 15 Pounds,  
And 13 Pounds equal 12 Guineas,  
What will 650 Guineas equal?  
Answer, 1408 Angels <sup>1</sup>/<sub>3</sub>.

## Double Golden Rule in DECIMALS. 203

In this Question it was required to know, how many of the first would equal such a Number of the last, and by some is called the Compound Rule Descending: But if it had been required to know, how many of the last would countervail such a Number of the first; then, in this Question you must have multiplied the 2d, 4th, 6th, 8th, and 9th, for a Dividend; and the Product of the 1st, 3d, 5th, and 7th, would have been the Divisor; and this is commonly called the compound Rule Ascending.

### QUEST. IV.

There is a Cistern hath three Cocks; the first will empty the Cistern in a Quarter of an Hour, the second in half an Hour, the third in three Quarters of an Hour; in what Time will all the three Cocks empty this Cistern?

H. C. H.

First, If .25 : 1 :: 1 : Facit 4 Cisterns.

2dly, If .5 : 1 :: 1 : Facit 2 Cisterns.

3dly, If .75 : 1 :: 1 : Facit 1.333 Cisterns.

7.333

H. C.

Then say If 7.333 : 1 :: 1 : 7.333  
 7.333) 1.0000 (.13636 equal to 8 Minutes  
 and 11 Seconds, *per*.

7333

26670

21999

46710

43998

27120

21999

51210

Dd

QUEST.

# 164 Double Golden Rule in Decimals.

A Conduit hath a Cock, which running into a Cistern, will fill in 10 Minutes, or  $\frac{1}{6}$  of an Hour. This Cistern hath 3 Cocks, one before, and one on each side, that before will empty the Cistern in an Hour, that on the right Side in  $\frac{1}{2}$  an Hour, that on the left in  $\frac{1}{4}$  of an Hour; in what Time will this Cistern be filled, all running?

H. V. C. H. A. V. C.

First say, If 1666 : 1 :: 1 : Facit 6 the filling Cock.

Secondly, If 1 : 1 :: 1 : Facit 1 the emptying Cock.

Thirdly, If 75 : 1 :: 1 : Facit 1.333 emptying Cock.

Fourthly, If 5 : 1 :: 1 : Facit 2 emptying Cock.

Filling Cistern = 6

Empt. Cistern = 4.333

H. A. H.

an Difference : 1.666 : 25. If 1666

Then say, If 1666 : 1 :: 1 : Facit 26 Hours, or 36 Minutes the Answer.

## QUEST. VI.

A Cock of a Conduit runneth into a Cistern, and filleth it in five Hours; this Cistern hath a Cock that will empty it in 12 Hours. In what Time will the Cistern be filled, if both run at once?

First, I say, If 5 Hours fill one Cistern, what will one Hour fill? Facit .2 of a Cistern.

Say again, If 12 Hours empty one Cistern, what will one Hour empty? Facit .0833 of a Cistern.

From .2 the filling Cock,

Subt. .0833 the emptying Cock,

Diff. .1166

8000

Then say, If .1166 of a Cistern require one Hour, what will one Cistern require? Facit 8.5645, or 8 Hours, 33 Minutes, and 52 Seconds, the Answer.

QUEST.

10

QUEST.



2 QUANTITIES.

If Wine worth 15  $\text{l.}$  12  $\text{s.}$  9  $\text{d.}$  be sufficient for the Ordinary of 100 Men, when it is worth 25  $\text{l.}$  15  $\text{s.}$  per Tun, how many Men will 3 Pounds worth satisfy, when Wine is worth 50  $\text{l.}$  per Tun?

*Men.*  $15.6375 : 100 :: 3 : \text{Facit } 19.184$

Say again, If 25.75  $\text{l.}$  per Tun suffice 19.184, what Number of Men will 50  $\text{l.}$  per Tun require? *Facit* 10 Men, *ferè.*

|         |        |    |        |
|---------|--------|----|--------|
| 15.6375 | 100    | 3  | 19.184 |
| 25.75   | 19.184 | 50 | 10     |

*Rule of Practice in DECIMALS.*

**A**lthough we have treated before of the *Rule of Practice*, yet because many times your Question may consist of Integers, and Fractional Parts, and seeing many times Questions may be more easily wrought, by reducing the Parts into Decimals, whereby the Operation will be the same as in Integers; we thought fit to give the Learner a Touch thereof, no one having done it before.

First, If at any time your Question consists of the Aliquot Parts of two Shillings, your Question may be wrought at one Operation, without reducing the Answer into Pounds; for two Shillings being the Decimal Part of a Pound, the Answer at two Shillings is found by Inspection, by separating the last Figure towards the Right-hand from the rest, for a Decimal Fraction; the rest is Pounds.

*E X A M P L E S.*

(1.) At 6  $\text{s.}$  the Yard, what will 64  $\frac{3}{4}$  Yards cost?

*Ans.*  $19 : 5 : 9 \frac{1}{2}$

(2.) At 8  $\text{d.}$  the Yard, what will 144 Yards cost?

*Ans.* At 2  $\text{s.}$  is 14.4.

$\frac{1}{3}$  for 8  $\text{d.}$  is 4.8 or 4  $\text{l.}$  16  $\text{s.}$

*Ans.* 4  $\text{l.}$  16  $\text{s.}$

# 206 Rule of Practice in DECIMALS.

## More EXAMPLES.

|                                                                                                                        |                                                                                                                                 |
|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| (3.)<br>At 4 d. the Yard, what<br>will 144 Yards cost?<br>At 2 s. 14.4<br>$\frac{1}{2}$ Part is 2.4<br>Answ. 2 l. 8 s. | (4.)<br>At 3 d. the Yard, what<br>will 145 Yards cost?<br>At 2 s. 14.5<br>$\frac{1}{2}$ Part is 1.8125<br>Answ. 1 l. 16 s. 3 d. |
|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|

And if your Question consist not of Aliquot Parts of two Shillings, you may easily divide it into Aliquot Parts, as in the Examples following.

|                                                                                                                                                                                                     |                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (1.)<br>At 9 d. the Yard, what<br>will 724 Yards cost?<br>$\frac{1}{10}$ Yards is 72.4<br>$\frac{1}{4}$ for 6 d. is 18.1<br>$\frac{1}{5}$ of 6 d. for 3 d. is 9.05<br>Sum 27.15<br>Answ. 27 l. 3 s. | (2.)<br>At 16 d. the Yard, what<br>will 721 Yards cost?<br>$\frac{1}{10}$ is 72.1<br>$\frac{1}{4}$ for 8 d. is 24.0333<br>the same 24.0333<br>Sum 48.0666<br>Answ. 48 l. 1 s. 4 d. |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

And so of any other.

Now seeing half the Number of Shillings is the Decimal thereof, any Question of Practice, consisting of any Number of Shillings, may be answered by an easy Multiplication, and the Answer given in Pounds, and Parts of a Pound; the Value of which Fraction, by the compendious Method of valuing a Fraction of a Pound Sterling, taught in *Reduction* foregoing, may be known by Inspection.

## EXAMPLES.

|                                                                                                               |                                                                                                                                |
|---------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| (1.)<br>At 12 s. the Yard, what<br>will 72 Yards cost?<br>Mult. 72<br>By .6<br>Prod. 43.2<br>Answ. 43 l. 4 s. | (2.)<br>At 15 s. the Yard, what<br>will 65 Yards cost?<br>Mult. 65<br>By .75<br>325<br>455<br>Prod. 48.75<br>Answ. 48 l. 15 s. |
|---------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|

(3.)

— 232

# *Rule of Practice in DECIMALS.* 207

(3.)  
At 1 *l.* 13 *s.* 9 *d.* the Yard,  
what will 48 Yards cost?  
For one Pound is 48 *l.*  
Prod. by .65 for 13 *s.* is 31.2  
 $\frac{1}{2}$  of 48 for 6 *d.* is 1.2  
 $\frac{1}{2}$  of that for 3 *d.* is .6  

---

Anfw. 81 *l.* 0.

(4.)  
At 14 *s.* 8 *d.* the Yard,  
what will 144 Yards cost?  
Mult. 144  
By .7  

---

100.8  
4.8  $\frac{1}{2}$  of 14.4 for 8 *d.*  

---

Pr. 105.6 Anfw. 105 *l.* 12 *s.*

But if at any time, as often as it will happen that your given Number hath a Fraction annexed, such Fraction is to be reduced into a Decimal: So will the Operation be as easy and facil, as if it consisted of Integers only.

## *E X A M P L E.*

I. At 8 *d.* the Yard, what will 672  $\frac{1}{2}$  Yards cost?  
Your Number after Reduction stands thus, 672.6  
 $\frac{1}{10}$  for 2 Shillings is 67.26  
 $\frac{1}{3}$  of 2 Shillings for 8 *d.* is 22.42  
Anfw. is 22 *l.* 8 *s.* 4 *d.* 3 *q.*  $\frac{2}{10}$  or  $\frac{1}{5}$ .

II. At 3 *s.* 6 *d.* the Gros, what will 25  $\frac{1}{2}$  Gros cost?  
Your Number after Reduction stands thus, 25.75 Gros.  
Mult. by the Decimal of 3 *s.* 6 *d.* to wit, .175

12875  
18025  
2575  

---

4.50625

Anfw. 4 *l.* 10 *s.* 1 *d.*  $\frac{1}{2}$ .

Take a Question or two in *Averdupois Weight.*

At 5 *l.* 15 *s.* 7 *d.*  $\frac{3}{4}$  the Hundred, what will 218 C. 3 *qr.* and 24 *lb.* cost?

See



# 208 Rule of Practice in DECIMALS

See the Work at large.

The Weight reduced stands thus,  $218.06128$   
 Multiply by  $15.78220$   


---

 $197067887$   
 $43792456$   
 $43792459$   
 $175171424$   
 $153274996$   
 $109482140$

See Kersey upon Wingate,  
 Page 334. 10 8 4

Ans.  $12661.2s. 3d. 3q. ferd.$   $12661.14$

The Work by Contraction in Multiplication of Decimals.  
 Multiplicand  $218.06128$   
 Multiplier Inverse  $922875$

$1094821$   
 $153275$   
 $17517$   
 $438$   
 $44$   
 $19$

Answer  $12661.2s. 3d. 3q. ferd.$   $1266.14$   
 as before.

## QUEST. II.

At  $11. 17s. 5d. \frac{1}{4}$  the Hundred, what will  $57 C. 2q. 17 lb. 11 oz.$  cost?

The Multiplicand  $57.6579$   
 Multiplier Inverse  $78178.1$

$576579$   
 $461263$   
 $40360$   
 $577$   
 $461$   
 $40$

Answer  $1071. 18s. 6d. \frac{3}{4}$   $107.9280$

Take a Question or two in Lead-Weights.

QUEST. I.

At 9<sup>l</sup>. 17<sup>s</sup>. 5<sup>d</sup>. the Fodder of Lead, what will 17  
Toder, 14 Hundred, 1 Quarter, and 17 Pound cost? 19  
Hundred and half, one Fodder.

The Multiplicand 17.73855  
Multiplier Inverse 8.38078

See Spiedel's *Arithmetical Ex-  
traction*, Page 95 and 96,  
where you may find the Work  
of this Question, whereby you  
may see the Facility of this  
Operation from that.

Answer, 175<sup>l</sup>. 15<sup>s</sup>. 10<sup>d</sup>.

But lest the Learner should stumble in reducing these  
Sorts of Weights into Decimals, and seeing they are useful  
Operations, I thought it convenient, for the Learner's  
Advantage, to annex a *Decimal Table* for that purpose;  
and it is as followeth.

| Grains | Decimals   | Grains | Decimals   |
|--------|------------|--------|------------|
| 1      | 0.00000000 | 1      | 0.00000000 |
| 2      | 0.00000000 | 2      | 0.00000000 |
| 3      | 0.00000000 | 3      | 0.00000000 |
| 4      | 0.00000000 | 4      | 0.00000000 |
| 5      | 0.00000000 | 5      | 0.00000000 |
| 6      | 0.00000000 | 6      | 0.00000000 |
| 7      | 0.00000000 | 7      | 0.00000000 |
| 8      | 0.00000000 | 8      | 0.00000000 |
| 9      | 0.00000000 | 9      | 0.00000000 |
| 10     | 0.00000000 | 10     | 0.00000000 |
| 11     | 0.00000000 | 11     | 0.00000000 |
| 12     | 0.00000000 | 12     | 0.00000000 |
| 13     | 0.00000000 | 13     | 0.00000000 |
| 14     | 0.00000000 | 14     | 0.00000000 |
| 15     | 0.00000000 | 15     | 0.00000000 |
| 16     | 0.00000000 | 16     | 0.00000000 |
| 17     | 0.00000000 | 17     | 0.00000000 |
| 18     | 0.00000000 | 18     | 0.00000000 |
| 19     | 0.00000000 | 19     | 0.00000000 |
| 20     | 0.00000000 | 20     | 0.00000000 |
| 21     | 0.00000000 | 21     | 0.00000000 |
| 22     | 0.00000000 | 22     | 0.00000000 |
| 23     | 0.00000000 | 23     | 0.00000000 |
| 24     | 0.00000000 | 24     | 0.00000000 |
| 25     | 0.00000000 | 25     | 0.00000000 |
| 26     | 0.00000000 | 26     | 0.00000000 |
| 27     | 0.00000000 | 27     | 0.00000000 |
| 28     | 0.00000000 | 28     | 0.00000000 |
| 29     | 0.00000000 | 29     | 0.00000000 |
| 30     | 0.00000000 | 30     | 0.00000000 |

A TABLE

# 110 Rule of Practice in DECIMALS.

## A TABLE of Lead Weight.

| Lead-Weight in<br>Decimals, one Fad-<br>der the Integer. | Pounds   Decimals.  | Quar. Oz.   Decim. |
|----------------------------------------------------------|---------------------|--------------------|
| Hund.   Decimals.                                        |                     |                    |
| 19.974358                                                | 21.0096153          | 31.0000214         |
| 18.923076                                                | 20.0091575          | 2.0000143          |
| 17.871794                                                | 19.0086996          | 1.0000072          |
| 16.820512                                                | 18.0082417          |                    |
| 15.769230                                                | 17.0077838          |                    |
| 14.717948                                                | 16.0073260          |                    |
| 13.666666                                                | 15.0068681          |                    |
| 12.615384                                                | 14.0064102          |                    |
| 11.564102                                                | 13.0059523          |                    |
| 10.512810                                                | 12.0054945          |                    |
| 9.461528                                                 | 11.0050366          |                    |
| 8.410256                                                 | 10.0045787          |                    |
| 7.358974                                                 | 9.0041208           |                    |
| 6.307692                                                 | 8.0036630           |                    |
| 5.256410                                                 | 7.0032051           |                    |
| 4.205128                                                 | 6.0027472           |                    |
| 3.153846                                                 | 5.0022893           |                    |
| 2.102564                                                 | 4.0018315           |                    |
| 1.051282                                                 | 3.0013736           |                    |
|                                                          | 2.0009157           |                    |
|                                                          | 1.0004578           |                    |
|                                                          | Ounces.   Decimals. |                    |
| Quarter Hundred<br>Decimals.                             |                     |                    |
| 3.038461                                                 | 15.0004292          |                    |
| 2.025641                                                 | 14.0004006          |                    |
| 1.012820                                                 | 13.0003720          |                    |
|                                                          | 12.0003434          |                    |
|                                                          | 11.0003148          |                    |
|                                                          | 10.0002861          |                    |
|                                                          | 9.0002575           |                    |
|                                                          | 8.0002289           |                    |
|                                                          | 7.0002003           |                    |
|                                                          | 6.0001717           |                    |
|                                                          | 5.0001430           |                    |
|                                                          | 4.0001144           |                    |
|                                                          | 3.0000858           |                    |
|                                                          | 2.0000572           |                    |
|                                                          | 1.0000286           |                    |
| Pounds   Decimals.                                       |                     |                    |
| 27.0123626                                               |                     |                    |
| 26.0119047                                               |                     |                    |
| 25.0114469                                               |                     |                    |
| 24.0109890                                               |                     |                    |
| 23.0105311                                               |                     |                    |
| 22.0100732                                               |                     |                    |

TABLE

QUEST.



# Rule of Practice in DECIMALS. 211

## QUEST. II.

At 9<sup>l</sup>. 11<sup>s</sup>. 10<sup>d</sup>.  $\frac{1}{2}$  the Fodder, what will 18 Fodder,  
13 Hundred, 3 Quarters, 17 Pound, 13 Ounces cost?

The Weight reduced by the foregoing Table, is 18.7133

Multiplicator Inverse 52655.9

1684197

93567

9357

1122

37

9

Answer, 178<sup>l</sup>. 16<sup>s</sup>. 7<sup>d</sup>. ferè.

Product 178.8289

*Note,* Though some of the foregoing Questions be wrought by *Multiplication in Decimals*, and not by the Practical Way of Aliquot Parts before taught, the Reason thereof is, That in those, and the like particular Questions, the Practical Way is more intricate and tedious, and requires more Figures than the Method here used, as may be observed, if the Reader peruse Mr. *Spiedell's Arithmetical Extraction*, Page 95, 96, and 97, in the Practical Way of the said Questions.

Here follows a Question or two in Exchange, and so we will conclude this Rule.

## QUEST. I.

A Merchant hath received a Bill of Exchange for 593  $\frac{1}{2}$  Pieces, at 7 Shill. 9  $\frac{3}{4}$  Pence per Piece, what Sterling Money will they amount to? *Answ.* 231<sup>l</sup>. 16<sup>s</sup>. 8<sup>d</sup>. 2<sup>q</sup>.  $\frac{1}{2}$ .

*The Work.*

Number given 593.5

$\frac{1}{4}$  for 5 Shillings is 148.375

$\frac{1}{10}$  for 2 Shillings is 59.35

$\frac{1}{10}$  of 5 Shillings for 6<sup>d</sup>. is 14.8375

$\frac{1}{2}$  of 6<sup>d</sup>. for 3<sup>d</sup>. is 7.41875

$\frac{1}{4}$  of 3<sup>d</sup>. for 3<sup>q</sup>. is 1.85468

Sum 231.83593

E e

QUEST.

## QUEST. II.

One Bath changed 759 Double Pistolets at 11 s. 8 d.  $\frac{1}{2}$  per Piece, what will they come to? *Ans.* 444 l. 6 s. 7 d.  $\frac{1}{2}$

|                                  |         |
|----------------------------------|---------|
| Given Number                     | 759.    |
| $\frac{1}{2}$ for 10 Shillings   | 379.5   |
| $\frac{1}{10}$ of 10 s. for 1 s. | 37.95   |
| $\frac{1}{4}$ of 1 s. for 6 d.   | 18.975  |
| $\frac{1}{3}$ of 6 d. for 2 d.   | 6.325   |
| $\frac{1}{4}$ of 2 d. for 2 q.   | 1.58125 |

The Sum 444.33125

Hereunto let us annex a compendious Method of Buying or Selling, by the Hundred Neat, or Hundred *Averdupois*, as oft as your Question is but of a small Price.

For the Little, or true Hundred, for as many Farthings as the Pound costs, account twice so many Shillings, and once so many Pence.

For the great Hundred, or 112 Pound, as many Farthings as the Pound costs, twice so many Shillings, and once so many Groats the Hundred Groats will cost.

## EXAMPLES in both.

I. At 3 d.  $\frac{1}{2}$  the Pound, what will 100 Pound cost?

3 d.  $\frac{1}{2}$  is 14 Farth. twice so many Shill. are 28, or 1 l. 8 s. 0 d.  
Once so many Pence are 14, or 0 l. 1 s. 2 d.

*Answer*, 1 l. 9 s. 2 d. Sum 1 9 2

II. At 2 d. 1 q. the Pound, what will the Hundred *Averdupois*, or 112 Pound, cost?

2 d.  $\frac{1}{4}$  is 9 Farth. twice so many Shillings are 18, or 0 l. 18 s. 0 d.  
Once so many Groats is 9, or 0 l. 0 s. 9 d.

*Answer*, 1 l. 1 s. Sum 1 01 0

# Rule of Practice in DECIMALS. 213

I shall in this Place annex one Question, to make the Learner a good Husband, if possible.

The Question is, that if one square Yard of Land cost a Penny, what will buy an Acre, 160 Perches being an Acre, and 7 Yards a Perch?

|                        |    |                         |      |
|------------------------|----|-------------------------|------|
| Yards in a Perch       | 7  | Perches in an Acre      | 160  |
| Multip. by itself      | 7  | Square Yards in a Perch | 49   |
| Product                | 49 |                         | 1740 |
| Square Yds. in a Perch |    |                         | 640  |

Yards in an Acre 7840

At 1 d. the Yard, what will 7840 Yards cost?

$$6513 = 4 d.$$

Facit 32 l. 13 s. 4 d.

And the yearly Rent which 32 l. 13 s. 4 d. will purchase at 6 per Cent. Compound Interest, on the Annual Rent of an Acre, will, by the Rules in Compound Interest following, be found to be 1.96 l. or 1 l. 19 s. 2 d. 1 q.  $\frac{1}{10}$ , very near 40 Shillings.

Whereby it is evident, That he that spends one Penny, spends or makes away a square Yard of as good Land as most in *England*, from him and his Heirs for ever.

And it is a Question whether *England* be worth 20 Shillings an Acre annually, taking one Acre with another. How much good Land we make away, it is easy to judge.

And he that spends a Penny a Day, spends one Pound, one half Pound, one Groat, and one Penny; and so by consequence, two Pence a Day will be two Pounds, two half Pounds, two Groats, and two Pence; and three Pence three Pounds, three half Pounds, three Groats, and three Pence, &c. per Year.



## Extraction of the Square Root.

**A** Square Number is that which is contained under two equal Numbers, or which is equally equal. So 4 is a square Number, contained under 2 equal Numbers; to wit, 2 and 2; for two times 2 is 4: And the square Number 9 is contained under 3 and 3; for 3 times 3 makes 9; and of the rest as in the following Table.

*A Table of Squares, with their Genitive equal Numbers, as far as the first 9 Digits.*

| Equal Numbers. |      |   |    | Squares |
|----------------|------|---|----|---------|
| 1              | into | 1 | is | 1       |
| 2              | into | 2 | is | 4       |
| 3              | into | 3 | is | 9       |
| 4              | into | 4 | is | 16      |
| 5              | into | 5 | is | 25      |
| 6              | into | 6 | is | 36      |
| 7              | into | 7 | is | 49      |
| 8              | into | 8 | is | 64      |
| 9              | into | 9 | is | 81      |

And when it is required to extract the square Root of any given Number, we have nothing to do but to find that equal Number of which it is composed: So if the Root of 16 were required, it would be found to be 4, as in the said Table.

Here 4 is the Root, called by some the first Power, and 16 is the Square, called the second Power.

Of Numbers to be extracted, are three Sorts.

*First, Single.*

*Secondly, Compound.*

*Thirdly, Irrational.*

Single are such Squares as are composed, or made up of any of the 9 Digits; of which Sort are those in the foregoing Table.

Compound

## *Extraction of the Square Root.* 215

Compound are all such Squares that are composed of more Figures than one, as 100, whose Root is 10; 121, whose Root is 11; or 144, whose Root is 12, &c.

Irrational are all such Squares, whose Roots cannot be discovered by Art exactly, neither in whole Numbers or Fractions, but something will still remain, there being no Proportion yet found betwixt an irrational Number and its Root; such Numbers are 3. 7. 19. 74. 156. 751, &c.

The Extraction of the Square Root is not much unlike Division; only there our Divisor is fixed, here we are to seek a new one for each Operation.

The Root of any single square Number is found by Inspection, as in the foregoing Table may be seen.

But if it be a compound square Number, it must be prepared by pointing thus: Make a Point under your Unit's Place, and omitting one, point every other Figure. And as many Points as your Number contains, so many Figures will your Root consist of.

Then proceed by the following Directions:

### *A Rule to be got by Heart.*

*The Root of your first Period you  
Must place in Quote; if you work true:  
Whose Square from your said Period then  
You must subtract; and so the Remainder  
Another Period being brought,  
You must divide as here is taught,  
By the Double of your Quote, but see  
Your Unit's Place you do leave free;  
Which Place will be supply'd by the Square  
Of your next quoted Figure there.  
Next multiply, subtract, and then  
Repeat your Work unto the End;  
And if your Number be irrational,  
Add Pairs of Cyphers for a Decimal.*

# 216 Extraction of the Square Root.

## EXAMPLE.

Let it be required to find the Square Root of 451584.

Having pointed it as in the Work, *The Work.*

Shews the Root will have three Places. 451584 (67

1. Seek the greatest Root of your first

Period 45, which by your Table you

will find to be 6, which place in your

Quotient, and the Square thereof under

45 your first Period, subtract 36 from

45, rest 9. This is your first Work, 451584 (67

and is no more to be repeated.

2. To the Remainder bring down

your next Period 15, makes 915 for a

Dividend, or, as some call it, a Resol-

vend, as you may see in the Work. 915

3. Double your Quote 6, makes 12

for a Divisor, then seek how oft 12 in

91, or how oft 1 in 9 (reserving the

Unit's Place for the Square of my sought

Figure) which I find to be 7, which I

place in my Quotient; and to save

trouble of Addition, to the Right-hand

of my Divisor as a Part thereof, making

it 127; then multiplying 127 by 7, the

Product I place under my Dividend, or

Resolvend, as you see. 127)915

This Work is every time to be re-

peated. 889

4. Subtract 889 from 915, rest 26,

to which I bring down my third and last

Period 84; then shall I have 2684 for

a new Dividend, to 1 Resolvend, as you

may see in the Work itself. 127)915

889

2684



## Extraction of the Square Root. 217

5. Double your Quotient 67, *facit* 134 for a new Divisor; then I ask how oft 134 in 268, (still reserving my Unit's Place in the Dividend) or, which is the same, how oft 1 in 2?

*Answ.* 2 times, which I place in my Quotient, and likewise on the Right-hand of my Divisor, making it 1342; then multiplying 1342 by 2, the Product, to wit, 2684, I place under my Dividend, and seeing they are equal, and that nothing remains, I find my Number was a square rational Number, and the Root is 672.

To prove your Work, multiply 672 = Root

By 672

$$\begin{array}{r} 1344 \\ 4704 \\ 4032 \\ \hline \end{array}$$

451584 = given Number.

After the like manner the Square Root of 2985984 would be found to be 1728.

But if your Number to be extracted, have a Remainder, then you may know it is irrational, and the Root cannot be got exact: Although by adding Cyphers, you may come as near the Truth as you please.

### EXAMPLE.

Let it be required to extract the Square Root of 160, or, which is the same, to find the Length of one Side of a square Acre.

Having

## 288 Extraction of the Square Root.

Having pointed my Number, and wrought as before, I find 12 for my nearest Root, and 16 to remain; to which adding two Cyphers, I find my next Figure to be 6; which I cut off from the rest, as part of a Decimal Fraction, which by continually adding Pairs of Cyphers to each Remainder, I increase to 5 Places, which is exact enough, not wanting 2 Parts, if Unity were divided into a hundred thousand Parts; for if I square 12.64911, it will produce 159.9999837921.

Thus the Square Root of any mixt Number may be found, the fractional Part first reduced into even Places of Decimals, or supplied, if need be; so if the Square Root of  $17\frac{1}{2}$  were required to 3 Places of Decimals, the Work would stand as here, and the Square Root would be 4.183.

See the Work.

160)12.64911

22)060

44

246)1600

1476

2524)12400

10096

25289)230400

227601

252981)279900

252981

2529821)2691900

2529821

162079

See the Work.

17.500000)4.183

16

81)150

81

828)6900

6624

8363)27600

25089

2511

The

*Extraction of the Square Root.* 219

The Square Root of a Vulgar Fraction, that is commensurable to its Root, may easily be found, by extracting the Square Root of the Numerator for the Numerator of the Root, and likewise the Square Root of the Denominator for the Denominator of the said Root, which Fraction is the Root sought. So if the Square Root of  $\frac{9}{49}$ , were required, it would be found to be  $\frac{3}{7}$ , for the Square Root of 9 is 3, of 49 is 7, equal to  $\frac{3}{7}$ : and so of any other.

After this manner may the Square Root of a mixt Number, which is commensurable to its Root, be easily found.

But if your Fraction be incommensurable to its Root, then the best way will be to reduce it into a Decimal, and extract the Root as before taught.

So if the Square Root of  $\frac{8}{9}$  were required unto 4 Places of Decimals, it would be .1036, as you see in the Work.

$\frac{3}{80}$  is equal to .0375

Then 10375 (-1936)

[illegible]

But if you have it to fall in some Operation, you may prefix its radical Sign before it thus,  $\sqrt{\frac{3}{4}}$ ; and so of any other.

In the last Place, I will shew how to find the Square Root of an irrational Number nearly, without the Help of Decimals, being a useful Notion for such as understand not those Fractions: And it is thus.

After you have found the integral Part of your Root to its Quadruple, add Unity for the Denominator of the fractional Part, and the Remainder doubled is Numerator : So the Root of 160 in this Method will be  $12\frac{2}{3}$ ; and thus of any other.

F f 12  $\frac{160}{144}$  Ex-  
 $\frac{4}{49}$   
 $\frac{49}{49}$   
 $\frac{49}{49}$



## Extraction of the Cube Root.

I. **A** Cube Number is that which is contained under 3 equal Numbers, or which is equally equal.

So 8 is a Cube Number, contained under 3 equal Numbers, to wit, 2, 2 and 2, for 2 times 2 is 4, and 2 times 4 is 8; and the Cube Number 27, is contained under 3, 3 and 3, for 3 times 3 is 9, and 3 times 9 is 27; and of the rest as in the following Table.

**A TABLE of Cubes, with their Genitive equal Numbers as far as the 9 Digits.**

| Equal Numbers. |   |      |   |   |      |   |    |   | Cubes. |
|----------------|---|------|---|---|------|---|----|---|--------|
| 1              | — | into | 1 | — | into | 1 | is | — | 1      |
| 2              | — | into | 2 | — | into | 2 | is | — | 8      |
| 3              | — | into | 3 | — | into | 3 | is | — | 27     |
| 4              | — | into | 4 | — | into | 4 | is | — | 64     |
| 5              | — | into | 5 | — | into | 5 | is | — | 125    |
| 6              | — | into | 6 | — | into | 6 | is | — | 216    |
| 7              | — | into | 7 | — | into | 7 | is | — | 343    |
| 8              | — | into | 8 | — | into | 8 | is | — | 512    |
| 9              | — | into | 9 | — | into | 9 | is | — | 729    |

And when it is required to extract the Cube Root of any given Number, we have nothing to do but to find that equal Number of which it is composed: so if the Root of 64 were required, it would be found to be 4, as in the Table.

Here 4 is the Root, or first Power, and 4 times 4 is 16, the second Power, and 4 times 16 is 64, or the third Power, which is the Cube.

Of Cube Numbers to be extracted, are three Sorts.

*First,*

*First, Single.*

*Secondly, Compound.*

*Thirdly, Irrational.*

Single are all such Cubes as are composed or made up of any of the 9 Digits, of which Sort are those in the foregoing Table.

Compound are all such Cubes that are composed of more Figures than one, as 1000, whose Root is 10, or 1331, whose Root is 11, or 1728, whose Root is 12, &c.

Irrational are all such Cubes, whose Root cannot be discovered by Art exactly, neither in whole Numbers, nor Fractions, but something will still remain, there being no Proportion yet found betwixt an irrational or Surd Number and its Root; such Numbers are 5. 7. 36. 160. 1526, &c.

The Extraction of the Cube Root participates something of the Nature of Division, yet a deal more difficult. The Root of any single Cube Number is found by Inspection, as in the foregoing Table may be seen.

But if it be a Compound Cube Number, it must be prepared by pointing thus: Make a Point under your Unit's Place, and omitting Two, point every third Figure, and as many Points as your Number contains, so many Figures will your Root consist of. Then proceed by the following Directions.

*A Rule to get by Heart.*

*The Cube of your first Period take,  
And of its Root a Quotient make;  
Which Root into a Cube must grow,  
And from your Period taken fro:  
To the Remainder then you must  
Bring down another Period just;  
Which being done, then you must see  
Your Number straight divided be  
By just three hundred times the Square  
Of what your Quotient Figures bear;  
Which do, so that you in may take  
The Fact your Quotient Figures make;  
Last, squar'd and multiply'd by th' rest  
And Product thirty times exprest.*

*Extraction of the Cube Root.*

*The Cube of your last found Figure too  
 You must put in, if right you do;  
 Repeat your Work, and so descend  
 From Point to Point unto the End;  
 That done, if ought remain there shall  
 Add trebled Cyphers for a Decimal.*

*E X A M P L E.*

Let it be required to extract the Cube Root of 46656.

1. First, Point your Numbers as directed, whereby you may see the Root will have but two Places.

2. Seek the greatest Root of your first Period 46, which by the foregoing Table you will find to be 3; which place in your Quotient, and the Cube thereof 27 place under 46. Subtract 27 from 46, and there will rest 19, as you see, if you observe the Work: This is your first Work, and no more to be repeated.

|       |    |
|-------|----|
| 46656 | (3 |
| 27    |    |
| 19    |    |

3. To your Remainder 19, bring down your next and last Period 656, and it will make 19656 for a Dividend; then square your Quotient, 3 makes 9, which multiply by 300, produceth 2700 for a Divisor. Seek how oft 2 in 19; *Answ.* But 6 times, because of the Increase that will come from my Quotient. Then I multiply my Divisor by 6, and the Product 16200 I place orderly under my Dividend, having separated them with a small Line; then proceed to find the Increase coming from my Quotient; thus square your last Figure 6, *facit* 36, which multiply by the rest of your Quotient here by 3, *facit* 108, and this by 30, *facit* 3240, which place orderly under my last Number 16200; then cube the Figure last placed in your Quotient here 6, *facit* 216, which place orderly under your last Number 3240, and add your 3 Subducends (for so many you have in every Operation after the first) into one Sum, *facit* 19656; and seeing it is equal to my Dividend, and no more Periods to bring down, I see my Work is finished, and my Number a right Cube Number, and the Root is 36.

*Note,* As many Operations or Periods as you have, except the first, so oft this last Work is to be repeated.



## Extraction of the Cube Root. 213

*See the Work.*

46656 (36 Quote equal the Root.

27

2700) 19656 Dividend.

16200

3240

216

} Subducends.

Sum 19656 From Dividend sub.

Rest 00

P R O O F.

Root 36

Square 1296

36

Root 36

216

7776

108

3888

Square 1296

46656

### E X A M P L E II.

Let it be required to find the Cube Root of this Number 673373097125.

1. First, I point my Number, by which I see my Root will have four Places.

2. Next, seek the greatest Root of your first Period 673, which by the Table is 8, which place in your Quote, and the Cube thereof 512, place under 672, and subtract. Rest 161; this is the first Work, and no more to be repeated.

673373097125 (8

512

161

3. To the Remainder 161, bring down your next Period 373, makes 161373 for a Dividend, to which 19200 (being 300 times the Square of 8 your Quotient) is a Divisor; and

# 224 *Extraction of the Cube Root.*

and considering how oft my Divisor is contained in my Dividend (so as to allow Place for my Subducends) I find it 7 times; place 7 in the Quotient, by which multiplying my Divisor, the Product I place under my Dividend for my first Subducend. Next, I square my last Figure 7, which multiplied by 8, and then by 30, gives 11760 for my second Subducend, which I place under my last, and the Cube of 7, my last quoted Figure, is my third Subducend, which I place under the other two, and adding them; the Sum is 146503, which I subtract from my Dividend; and the Remainder is 14870; then will the Work appear thus:

$$\begin{array}{r}
 673373097125 \quad (87 \\
 \underline{512} \\
 \text{1 Divisor } 19200) \quad 161373 \quad \text{Dividend 1:} \\
 \underline{134400} \\
 11760 \quad \left. \vphantom{\begin{array}{l} 134400 \\ 11760 \end{array}} \right\} \text{Subducends.} \\
 \underline{343} \\
 \text{Sum } 146503 \quad \text{From Dividend subtract:} \\
 \underline{\hspace{1cm}} \\
 \text{Rest } 14870
 \end{array}$$

3. To this Remainder bring down your next Period 097; then will your second Dividend be 14870097, to which 2270700 (being 300 times the Square of your Quotient 87) is the Divisor, and dividing by the Caution before given, I find the next Figure of my Root to be 6, and my first Subducend is 13624200 square 6, *facit* 36, which multiplied by 87, makes 3132, and this by 30, gives 93960 for my second Subducend, and the Cube of 6, which is 216, is my third Subducend; which placed as before taught, and as you see in the Work, and then added, the Sum is 13718376, which I subtract from my last Dividend, and the Remainder is 1151721.

Then will the Work appear as in the following Operation.

6733730-

# Extraction of the Cube Root.

229

673373097125 (876)

512

1. Divisor 19200) 161373 Dividend (1.)

134400 }  
1760 } Subducends.  
343 }

Sum 146303 From Dividend Sub,

2. Divisor 2270700) 12870697 Dividend (2.)

13624200 }  
93960 } Subducends.  
216 }

Sum 13718376 From Dividend Sub,

Rem 1151721

4. To this Remainder bring down the last Period 125, and your third and last Dividend will be 1151721125, to which 230212800 is Divisor, which is 300 times the Square of 876 your Quotient; and dividing as before, I find my fourth Figure to be 5, and my first Subducend is 1151064000, and mult. 876 by the Square of 5, and that by 30, gives 657000 for my second Subducend, and the Cube of 5, to wit 125, is my third Subducend, which added into one Sum, makes 1151721125; and seeing it is equal to my last Dividend, and no more to bring down, I see my Work is finished, and the Number given, a right Cube Number; and my Root sought is 8765. And the whole Work appears as here.

230212800  
657000  
125  
1151721125

230212800  
657000  
125  
1151721125

673373097125  
1151721125  
230212800  
657000  
125  
1151721125



673373097125 (8765

512

(1.) Divisor 19200) 161373 Dividend (1.)

134400

11760

343

Subducends.

Sum 146503 From Dividend Sub.

(2.) Divisor 2270700) 14870097 Dividend (2.)

13624200

93960

216

Subducends.

Sum 13718376 From Dividend Sub.

(3.) Divisor 230212800) 1151721125 Dividend (3.)

1151064000

657000

125

Subducends.

Sum 1151721125 From Divid. Sub.

Rem

P R O O F.

Root 8765

8765

Mul.

Multiply

By

76825225 Square

87665

43825

52590

61355

70120

384126125

460951350

537776575

614601800

76825225 Square.

673373097125 Cube.

But if your Number to be extracted have a Remainder,  
it is then an irrational Number, and the exact Root cannot  
by

# *Extraction of the Cube Root.* 227

by Art be discovered, though you may find it near enough for Practice; if to the Remainder in every Operation you add 3 Cyphers, and so work as far as you will.

## *EXAMPLE.*

Let it be required to extract the Cube Root of 282, or, which is the same, to find the Side of that Cubical Vessel which shall just contain a Gallon of Ale, being 282 solid Inches.

*The Work.*

282 (6.557  
216

10800) 66000

.54000  
4500  
125

58625

1267500) 7375000

6337500  
48750  
125

6386375

128707500) 988625000

900952500  
962850  
343

901913693

Remainder 86709307

Seeing there will be but one Point in the given Number, the Integral Part of the Root is found by Inspection by your Table, and is six Inches; then adding three Cyphers to every Remainder throughout the whole Operation, I find the Fractional Part, to three Places of Decimals, to be .557; so that the Side of the Cubical Vessel is 6 Inches and 557 Parts of a Thousand. And thus of any other.

And after this manner may the Cube of any Fraction, or mixt Number, be found, by reducing the fractional Part into Decimals, either of 3, 6, 9, or 12 Places, as you desire your Root to be less or more exact.

G g

So

## 228. Extraction of the Cube Root.

So if the Cube Root of  $\frac{1}{8}$  were required, the Work too 3 Places of Decimals would stand thus, and the Root will be .908.

See the Work.

Let it be required to find the Cube Root of 282, which is the same, to find the Side of that Cubical Vessel which shall just contain a 282 solid Inches.

Ans. 2430000) 21000000

722.0) 282

19440000

172800

000000 (00801 512

19613312

Remt 1386688

So the Cube Root of 25 $\frac{1}{2}$  will be 2.9481, and so of any other.

But if your mixt Number or Fraction be commensurable to its Root, then you may extract the Cube Root of the Numerator for the Numerator of the Root, and the Cube Root of the Denominator for the Denominator of the said Root; so the Cube Root of  $\frac{27}{64}$  will be  $\frac{3}{4}$ ; for the Cube Root of 27 is 3, and of 64 is 4, which is  $\frac{3}{4}$ ; and so of any other.

But if your Fraction or mixt Number be incommensurable to its Root, you must work as before; or if you have no present Occasion for it, you may prefix its radical Sign. So the Cube Root of  $\frac{1}{16}$  would be expressed thus  $\sqrt[3]{\frac{1}{16}}$ ; and so of any other.

As in the Square Root, so here I will shew you how to find the Cube Root of an Irrational Number near, without the Use of Decimal Fractions, and it is thus:

After you have found the Integral Part of your Root, to the Treble thereof add Unity, and that Sum added to the Square of the said Root tripled, is the Denominator to which the Remainder is Numerator; so the Cube Root of 282 will be found to be 6 $\frac{6}{11}$ , which is near enough for ordinary Practice, or which is the same, if you find the Difference betwixt the Cube of the Root, and the Cube of the Root Plus Unity, you have the Denominator as before.

For

|                  |                  |                   |                   |                   |                   |
|------------------|------------------|-------------------|-------------------|-------------------|-------------------|
| $\frac{6}{78}$   | $\frac{6}{36}$   | $\frac{6}{36}$    | $\frac{6}{36}$    | $\frac{6}{36}$    | $\frac{6}{36}$    |
| $\frac{1}{19}$   | $\frac{3}{108}$  | $\frac{1}{36}$    | $\frac{49}{36}$   | $\frac{6}{36}$    | $\frac{216}{36}$  |
| $\frac{19}{127}$ | $\frac{19}{127}$ | $\frac{216}{127}$ | $\frac{216}{127}$ | $\frac{216}{127}$ | $\frac{216}{127}$ |



## *The Use of the Square and Cube Root.* 229

For the Cube of the Root 6, is 216, and the Cube of 7, viz. the Root plus Unity, is 343; their Difference is 127, which is the Denominator as before.

## *The Use of the Square and Cube Roots.*

**H**ERE follow some Uses of the Square and Cube Roots, both in Arithmetick and Geometry.

### P R O B L E M I.

To find a Mean Proportional between any two Numbers given.

#### R U L E.

The Square Root of the Product of the given Numbers is the Mean Proportional sought.

So a Mean Proportional between 16 and 64 will be 32.

This Problem is of excellent Use in finding the Side of a Square equal to any Parallelogram, Rhombus, Rhomboides, Triangle, or regular Polygon.

For if in a Parallelogram you suppose the two Sides, or in a Rhombus or Rhomboides, the Side and Perpendicular falling thereon: In a Triangle, the Base and  $\frac{1}{2}$  the Perpendicular, or Perpendicular and  $\frac{1}{2}$  the Base; and in a regular Polygon, the  $\frac{1}{2}$  Perimeter and Perpendicular, or  $\frac{1}{2}$  Perpendicular and Perimeter; I say, if you suppose them as two Numbers given, and by the foregoing Problem find a Mean Proportional given, is the Side of a Square equal sought.

From this Problem by Consequence follows Prob. 2.

### P R O B. II.

To find the Side of a Square equal in Area to any given Superficies whatsoever.

#### R U L E.

The Square Root of the Content of any given Superficies is the Side of the equal Square sought.

G g 2

So

$$\begin{array}{r} 4 \ 9 \ 6 \\ \sqrt{\phantom{00}} \\ 32 \end{array}$$

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So if the Content of a given Circle be 160, the Side of the Square equal will be  $12\frac{1}{2}$  feet, or more exact in Decimals 12.64911.

Here if you suppose the Content to be the Product of two Numbers, as in many Cases it is, it will be the same as to find a Mean Proportional betwixt those two Numbers.

### PROB. III.

The Area of a Circle given, to find the Diameter.

#### RULE.

As 355 : To 452 : or as 1 to 1.273239 : So the Area : To the Square of the Diameter.

What Length of Cord will fit to tie to a Cow-Tail, the other End fixed in the Ground, to let her have Liberty of eating an Acre of Grass and no more, supposing the Cow and Tail to be 5 Yards and a half.

Say, As 355 : To 452 : So 160 being the Area of a Circle, whose Content is an Acre : To 1031.183, whose Square Root is the Diameter (*viz.*) 32.1273 Perches, the Semi-diameter is 16.0636; from which subtract one Perch for the Cow and Tail, rest 15.0636 Perches for the Length of the Cord.

### PROB. IV.

The Area of a Circle given, to find the Periphery.

#### RULE.

Say, As 113 : To 1420, or as 1 to 12.56637 : So the Area : To the Square of the Periphery.

So if the Area of a Circle be 160, the Periphery will be found to be 44.84 feet.

### PROB. V.

The Sum of the Squares of two Numbers together, with the Square of the  $\frac{1}{2}$  Sum being given, to find the Numbers.

#### RULE.

From the Sum of the Squares subtract the doubled Square of the  $\frac{1}{2}$  Sum, half the Remainder is the Square of  $\frac{1}{2}$  their Difference; and if to the  $\frac{1}{2}$  Sum you add their half Difference, you have the greater Number, and by Subtraction, the less.

Let the Sum of the Squares of 2 Numbers be 3161, and the Square of their  $\frac{1}{2}$  Sum 1560.25, and let the 2 Numbers be sought.

The

*The Use of the Square and Cube Root. 231*

The doubled Square of the  $\frac{1}{2}$  Sum is 3120.5, which subtr. from the Sum of the Squares 3161, there will rest 40.5, half of which is 20.25, whose Square Root is 4.5, and is the  $\frac{1}{2}$  Diff. which add to the Square Root of 1560.25 (viz.) 39.5, and it will give 44, the greater Number; and if you subtr. 4.5 from 39.5, you have the less, to wit 35.

**P R O B. VI.**

The Sum of the Squares of two Numbers, together with the Square of their  $\frac{1}{2}$  Diff. being given, to find the Numbers themselves.

**R U L E.**

From the  $\frac{1}{2}$  Sum subtract the Square of  $\frac{1}{2}$  their Diff. the Remainder is the Square of the  $\frac{1}{2}$  Sum of those two Numbers; then work by the last.

Let the Sum of the Squares of two Numbers be 3161, and the Square of their half Diff. is 20.25; I demand the two Numbers.

Half the Sum of the Squares is 1580.5, from which subtr. 20.25, the Square of their half Diff. rest 1560.25, whose Square Root is 39.5, which is the  $\frac{1}{2}$  Sum; and the Square Root of 20.25, is 4.5; then the Sum of 4.5 and 39.5 is 44, the greater Number; and their Diff. is 35, the lesser Number.

**P R O B. VII.**

The Sum of the Squares of the half Sum, and half the Difference of two Numbers, with one of them, being given to find the other. The Rule follows.

From the doubled Sum of the said Squares subtract the Square of the given Number, the Remainder is the Square of the Number required.

Let the Sum of the Squares of  $\frac{1}{2}$  the Sum, and  $\frac{1}{2}$  the Diff. of 2 Numbers be 1580.5; and let the lesser Number be 35, from 3161, the double Sum of the Squares, subtract 1225, the Square of 35, the Remainder is 1936, whose Square Root is 44, which is the other Number.

**P R O B. VIII.**

Any two Sides of a right-angled Triangle being given, to find the third Side.

In this useful Problem lies hid a great Part of the Mathematicks, the Invention whereof is sathered upon Pythagoras; the Demonstration thereof Euclid hath in the

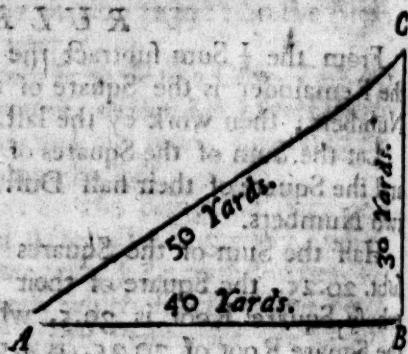


## 232 *The Use of the Square and Cube Roots.*

47th Proposition of the first Book of his *Elements*, of *Geometry*; where it is proved that the Square of the Hypothenuse, or longest Side of a right-angled Triangle, is equal to the Sum of the Squares of the Base and Perpendicular, or the other two Sides.

In the annexed Triangle *ABC*, let the Base or Ground *AB* represent the Breadth of a Moat or Ditch, and let the Perpendicular *BC* represent the Height of a Castle, Tower, or City Wall, and let the Hypothenuse, or longest Side, represent the Length of a Scaling-Ladder.

Let the Base *AB*, or the Breadth of the Ditch be 40 Yards, and the Perpendicular *BC*, or the Height of the Wall, be 30 Yards; what Length will the Hypothenuse *AC*, or the Scaling-Ladder be?



### *R U L E.*

The Square Root of the Sum of the Squares of the Base and Perpendicular, is the Length of the Hypothenuse.

*Ans.* 50 Yards the Length of the Ladder.

For the Square of the Base 40 is 1600

And the Square of the Perpend. 30 is 900

The Sum is 2500 (50 the Root.)

25

000

But if the Breadth of the Ditch were required, and the Perpend. and the Hypothenuse were given, then this is

### *The R U L E.*

The Square Root of the Difference of the Squares of the Hypothenuse and Perpendicular, is the Length of the Base, or Breadth of the Ditch.

For

## The Use of the Square and Cube Roots. 233

For the Square of the Hypot.  $AC$  is 2500  
And the Square of the Perpend.  $BC$  is 900

Diff: 1600 (40 Root.

Here you see the Base is 40

$$\begin{array}{r} 400 \\ 400 \\ \hline 1600 \\ 1600 \\ \hline 000 \end{array}$$

And if  $BC$  were required from the given Sides  $AB$ , and  $AC$ , then the Square Root of the Difference of the Distance of the Squares of the Hypotenuse and Base, is the Height of the Perpendicular, or  $BC$ .

### P R O B. IX.

To divide a Number given by Extream and Mean Proportion.

#### R U L E.

Multiply the Square of your given Number by 5, and divide the Prod. by 4, and from the Square Root of the Quotient subtract  $\frac{1}{2}$  your given Number, the Remainder is the greater Portion, which subtracted from the Whole, gives the less.

Let the given Number be 12, whose Square is 144, which multiplied by 5, produceth 720, which Product divided by 4, gives 180, whose Square Root is 13 $\frac{1}{2}$ , from which subtract 6,  $\frac{1}{2}$  your given Number, rest 7 $\frac{1}{2}$  for your greater Part, which subtracted from the whole Number 12, gives 4 $\frac{1}{2}$  for the less.

### P R O B. X.

Any Number of Men being given, to form them into a square Battle, or to find the Number of Ranks and Files.

#### R U L E.

The Square Root of the Number of Men given, is the Number of Men either in Rank or File.

Let there be an Army of Men of 32400, and let us form them into a square Battle: Extract the Square Root of 32400, and it will be found to be 180; which shews there will be 180 Men in Rank, and as many in File.

See.

## 234 The Use of the Square and Cube Roots

See the Work. For the square of 32400 (180 Root) to find the square of 180

$$\begin{array}{r} 32400 \\ \text{---} \\ 180 \end{array}$$

Here you see the Root is 40

$$\begin{array}{r} 224 \\ -28 \\ \text{---} \\ 224 \end{array}$$

000 000

Thus much shall suffice for the Use of the Square Root: We will now proceed to some Uses of the Cube Root. The chief Use of the Cube Root, is to find out a Proportion between the Solids, as Globes, Cylinders, Cubes, &c.

### P R O B. I.

If a Bullet of Brass of 8 Inches Diameter weigh 72 Pound, what shall a Bullet of Brass weigh, whose Diameter is 4 Inches?

### R U L E.

Since like Solids are in Triple Proportion to their Homologous Sides, Diameters, Lines, &c. it holds,

As the Cube of the Diameter given :

To the Weight thereof :

So the Cube of the Diameter sought :

To the Weight thereof.

See the Work.

C.D. 16. C.D.

If 512 : 72 :: 64

64

288

432

Facit 9 Pound.

512) 4608 (9

4608

### P R O B. II.

If a Ship of 100 Tun be 44 Feet Long at the Keel, of what Length shall the Keel be of a Ship of 220 Tun?

Say,



## The Use of the Square and Cube Roots. 835

Say, As 100 : To the Cube of 44 (viz. 85184) Asidw  
 So 200 : To 187401.80, whole Cube Root is 57.245.  
 the Length of the Keel sought.

### P R O B. III.

The Side of the Cube being given, to find the Side of  
 that Cube that shall be double, treble, &c. in Quantity  
 to the given Cube.

### R U L E.

Cube your Side given, and multiply it by 2, 3, &c.  
 The Cube Root of the Product is the Side sought.  
 There is a Cubical Vessel, whose Side is 12 Inches,  
 and it is required to find the Side of that Vessel which  
 shall contain 3 times as much.

The Cube of 12 is 1728

Multiply by

3

5184 Product

The Cube Root of which Product is 17.306, the Side  
 sought.

After the same Method may you find a Side that shall  
 contain  $\frac{1}{2}$  as much,  $\frac{1}{3}$  as much, or any other given Quantity.

### P R O B. IV.

To find the Side of a Cube that shall be equal in So-  
 lidity to any given Solid, as a Globe, Cylinder, Prism,  
 Cone, or such like.

### R U L E.

The Cube Root of the solid Content of any solid Body  
 given, is the Side of the Cube of equal Solidity.

So, if the Content of a Globe were found to be 15625  
 solid Inches, seek the Cube Root of 15625, which is 25,  
 which is the Side of a Cube of equal Capacity.

### P R O B. V.

Between two Numbers given, to find two mean Pro-  
 portionals.

### R U L E.

Multiply the less Extreme by the Cube Root of the  
 Quotient of the greater Extreme divided by the less, the  
 Product is the lesser of the two mean Proportionals;

H h

which

which multiplied by the said Cube Root, gives the greater Mean sought. So if two mean Proportionals betwixt 6 and 162 were sought, they would be found to be 18 and 54; for 162 divided by 6, quotes 27, whose Cube Root is 3; by which multiplying 6, the less Extreme, gives 18 for the less Mean; and 18 multiplied by the same Root 3, gives 54 for the greater; or if you divide the greater Mean by the same Root, it quotes the lesser Mean as before.

## P. R. O. B. VI.

The Concave Diameter of two Guns being known, together with the Quantity of Gun-powder sufficient to charge one, to find what will be sufficient to charge the other. The Capacities are one to another, as the Cubes of their Diameters.

## E X A M P L E.

If .45 Pound of Gun-powder be sufficient to charge a Gun, whose Concave Diameter is one Inch  $\frac{1}{2}$ , or 1.5, how much Gun-powder will suffice to charge a Gun whose Concave Diameter is 7 Inches? *Ans.* 45 Pound and  $\frac{1}{2}$ .

Say, As 3.375 : To .45 :: So is 343 : To 45.7 Pound.

But if the Gun-powder given and required, be of different Strengths, the Question requires two Operations; the first of which finds the Quantity either of a stronger or weaker Sort, and the Proportion is Inverse; the second is as in this Example. Many more Uses might be named, but let this suffice in this Place.

## Simple INTEREST.

**W**E shall proceed now to Interest of Money, wherein the greatest and most useful Practice of *Decimal Arithmetick* consists.

When a Sum of Money is lent by one to another for any Time agreed on, and an Allowance granted for the Loan of the same: Here the Money so lent is called the Principal or Stock, and the Allowance or Gain is called the Interest.

Interest formerly was very high, viz. 12, 10, or 8, per Cent. per Annum; but by an Act of Parliament made in August 1660, it was brought down to 6 per Cent. per Annum, and is now at 5 since 12 Q. Anne, above which no person dare pretend to take, or any obliged to give.

And a sufficient Person may have Money in most Places at 5 per Cent. per Annum, and in some Places for less.

Interest is either Simple or Compound.

When a Sum of Money is lent, and the Interest thereof when due, is not paid, but kept in the Borrower's Hands, and yet becomes not a Part of the Principal, then it is called Simple Interest.

The Business of Simple Interest is performed by a Rank of Numbers arithmetically proportional, from which naturally will arise this Theorem.

If a Pair of Ranks of Numbers shall be so posited, as to have the same common Ratio betwixt every Pair of Correspondents; then it follows, That the Numbers themselves, the correspondent Sums, and correspondent Differences, have the same common Ratio.

ILLUSTRATION.

|   |    |   |    |
|---|----|---|----|
| 2 | 8  | 6 | 30 |
| 3 | 12 | 7 | 35 |
| 4 | 16 | 8 | 40 |
| 5 | 20 | 9 | 45 |

|    |    |    |     |
|----|----|----|-----|
| 14 | 56 | 30 | 150 |
|----|----|----|-----|

In the first Pair of Ranks, the Ratio is 4: then you may take any Number in the first Rank of the first Pair, suppose 4, then it holds,

As 4: to 16:: So is 14: To 56, & contra understand the same in the second Pair of Ranks.

In the Solution of Questions of Simple Interest, four Things are to be considered.

First, The Principal or Money lent: Secondly, the Time for which it is lent: Thirdly, The Rate or Gain, suppose of one Pound in a Year: And, Fourthly, The Amount.



# Simple Interest.

Assuming of these being given, to find the fourth, as in these four Propositions following.

## PROPOSITION I.

Principal, Rate, and Time given, to find the Amount.

## RULE.

To the Product of the Rate, multiplied by the Time, add Unity; that Sum multiplied by the Principal, gives the Amount.

## EXAMPLE.

What will 20 amount to, forborn 7 Years, at 6 per Cent. Simple Interest?

Principal 20. Rate .06. Time 7 Years.

The Work.

06

7

1.42

20

28.40

Answer 28 l. 8 s.

## EXAMPLE II.

What will 36 Pound amount to, lent from May the 9th, 1753, until November the 17th next following, Simple Interest being computed at 5 per Cent. Principal 36, Rate .05, Time 526 Days. Answer 36 l. 18 s. 11 d.

526

05

1.02620

3 Months = 1 Year

4 Weeks = 1 Month

7 Days = 1 Week

36

675780

307890

36.94680

And

And seeing the Time is both given and required in Years and Parts, we have annexed a Decimal Table thereof supposing a Year the Integer, and divided, as noted before; the Use is the same as other Decimal Tables, and needs no Explanation.

Between May the 9th, and November the 17th, are 199 Days, gathered as in the annexed Work; and by the annexed Decimal Table is found to be 6 Months, 3 Weeks, and 3 Days. The Decimal of which is .526027. And because the fourth Figure is a Cipher, we have only used three Places, they being sufficient. To find the Days in every Month, Observe this old Rule.

Thirty Days hath September,  
April, June and November;  
All the rest have Thirty One,  
Excepting February alone,  
Which hath but 28 Days clear,  
And 29 every Leap Year.

| Month | Days | Decimal |
|-------|------|---------|
| Jan.  | 31   | .08547  |
| Feb.  | 28   | .07692  |
| Mar.  | 31   | .08547  |
| Apr.  | 30   | .07692  |
| May   | 31   | .08547  |
| June  | 30   | .07692  |
| July  | 31   | .08547  |
| Aug.  | 31   | .08547  |
| Sept. | 30   | .07692  |
| Oct.  | 31   | .08547  |
| Nov.  | 30   | .07692  |
| Dec.  | 31   | .08547  |
| Sum.  | 365  | .08547  |

EXAMPLE

To the Rate multiplied by the Time, add Unity; by which dividing the Amount, gives the Principal.

EXAMPLE

What present Money will pay a Debt of 125 £. 8 s. 6 d. seven Years hence, at 4 per Cent. Simple Interest? Answer 88 £. 4 s. 4 d. Rate .04 Time 7 Years 100

25

And that nothing may be wanting, we have added a small Table, which gives the Number of Days betwixt any two given Times with much Ease: As for

*Example.*

1. From the Beginning of the Year, to the 11th of July, what Number of Days?

Over-against July, on the Right-hand, I find 181, and 11 Days more makes 192, the Answer.

2. Betwixt May the 9th, and September the 17th next following how many Days? Subtract May 120 plus 9, equal to 129; from September 243 plus 17, equal 260, rest 131, the Number of Days sought.

3. From the 5th of November 1752, to the 16th of May 1753, how many Days?

Add 25, the Complement of 5, to 30 (the Days in November) to 31 found on the Left-hand November, and to that Sum add 120, for May plus 16, the Sum is 192; and those are the Number of Days sought.

But to proceed.

| The TABLE. |     |           |     |
|------------|-----|-----------|-----|
| 31         | 334 | January   | 00  |
| 55         | 306 | February  | 31  |
| 90         | 275 | March     | 59  |
| 120        | 245 | April     | 90  |
| 151        | 214 | May       | 120 |
| 181        | 184 | June      | 151 |
| 212        | 153 | July      | 181 |
| 243        | 122 | August    | 212 |
| 273        | 92  | September | 243 |
| 304        | 61  | October   | 273 |
| 334        | 31  | November  | 304 |
| 365        | 00  | December  | 334 |

### PROP. II.

The Amount, Rate, and Time being given, to find the Principal.

### RULE.

To the Rate multiplied by the Time, add Unity; by which dividing the Amount, quotes the Principal.

### EXAMPLE.

What present Money will pay a Debt of 28*l.* 8*s.* due seven Years hence, at 6 per Cent. Simple Interest? Amount 28.4*l.* Rate .06, Time 7 Years. *Ans.* 20*l.*



*The Work.*

$$\begin{array}{r}
 .06 \\
 7 \\
 \hline
 048 \\
 1.42 \quad 28.4 \quad (20 \text{ l.}) \\
 048 \\
 \hline
 284 \\
 \hline
 0
 \end{array}$$

**EXAMPLE II.**

What present Money will pay a Debt of 36.9468, or 36 l. 18 s. 11 d.  $\frac{1}{2}$  due 192 Days, or 6 Months, 3 Weeks, and 3 Days hence, Rebate being allowed at 5 per Cent. Simple Interest. Amount 36.9468, Rate .05, Time .526?

Answer, 36 l.

*The Work.*

$$\begin{array}{r}
 .526 \\
 .05 \\
 \hline
 1.02630 \quad 36.9468 \quad (36 \text{ l.}) \\
 307890 \\
 \hline
 615780 \\
 615780 \\
 \hline
 0
 \end{array}$$

**PROP. III.**

Principal, Amount, and Rate given, to find the Time.

**R.U.L.E.**

From the Amount subtract the Principal, the Difference divided by the Product of the Principal and Rate, gives the Time.

**EXAMPLE.**

In what Time will 20 l. raise a Stock of 28 l. 8 s. or 28.4 at 6 per Cent. Simple Interest; Principal 20 l. Amount 28.4, Rate .06? Answer, in 7 Years.

*The*

## The Work.

$$\begin{array}{r}
 20 \text{ do. } 28.4 \\
 .06 \quad 20 \\
 \hline
 1.20 \quad (1.20) \quad 8.40 \quad (7) \\
 1.82 \quad 840 \\
 \hline
 0 \quad 0
 \end{array}$$

## EXAMPLE II

In what Time will 36 Pound amount to 36.9468, or, 36.9468 at 5 per Cent. Simple Interest: Principal 36. Amount 36.9468. Rate .05. Answer, in 6 Months, 3 Weeks, and 3 Days.

## The Work.

$$\begin{array}{r}
 36.9468 \\
 36. \\
 \hline
 801.80 \quad (36.9468) \quad (.526 = 191 \text{ Days, or } 6 \text{ Months, } 3 \text{ Weeks and } 3 \text{ Days.}) \\
 36 \quad 900 \\
 .05 \quad 087210 \\
 \hline
 1.80 \quad 037210 \quad 468 \\
 \hline
 0 \quad 360 \\
 1080
 \end{array}$$

## PROB. IV.

The Principal, Time, and Amount given, to find the Rate?

## RULE.

From the Amount subtract the Principal, the Remainder divided by the Product of the Principal and Time, gives the Rate.

E X.

## EXAMPLE.

At what Rate of Simple Interest will 20 *l.* amount to 28.4 in 7 Years? *Answer, 6 per Cent.*

*The Work.*

|   |     |          |
|---|-----|----------|
| 0 | 20  | 28.4     |
|   | 7   | 20       |
|   |     | <hr/>    |
|   | 140 | 8.40 (06 |
|   |     | 840      |
|   |     | <hr/>    |
|   |     | 0        |

## EXAMPLE II.

If 36 *l.* amount to 36.9468, or 36 *l.* 18 *s.* 11 *d.*  $\frac{1}{2}$  in 6 Months, 3 Weeks, and 3 Days, what Rate of Simple Interest is implied in this Bargain; Principal 36, Time .526. Amount 36.9468? *Answer, 5 per Cent.*

*The Work.*

|        |                     |
|--------|---------------------|
| .526   | 36.9468             |
| 36     | 36.0                |
|        | <hr/>               |
| 3156   | 18.936) .94680 (.05 |
| 1578   | .94680              |
|        | <hr/>               |
| 18.936 | 0                   |

The two first Propositions being of most common Use, I have annexed two Tables, which give the Amount and Rebate, or the present Worth of any Sum of Money for any Time under 32 Years: The Construction of them lies in the *Propositions* themselves, by making one Pound the Principal in the first, and one Pound the Amount in the second; or if you divide Unity by the Number in the first Table, the Quotient is the Number in the second.



TABLE I.

Shewing the Amount of one Pound for 31 Years, at 5 and 6 per Cent. Simple Interest.

| Years | 5    | 6    |
|-------|------|------|
| 1     | 1.05 | 1.06 |
| 2     | 1.10 | 1.12 |
| 3     | 1.15 | 1.18 |
| 4     | 1.20 | 1.24 |
| 5     | 1.25 | 1.30 |
| 6     | 1.30 | 1.36 |
| 7     | 1.35 | 1.42 |
| 8     | 1.40 | 1.48 |
| 9     | 1.45 | 1.54 |
| 10    | 1.50 | 1.60 |
| 11    | 1.55 | 1.66 |
| 12    | 1.60 | 1.72 |
| 13    | 1.65 | 1.78 |
| 14    | 1.70 | 1.84 |
| 15    | 1.75 | 1.90 |
| 16    | 1.80 | 1.96 |
| 17    | 1.85 | 2.02 |
| 18    | 1.90 | 2.08 |
| 19    | 1.95 | 2.14 |
| 20    | 2.00 | 2.20 |
| 21    | 2.05 | 2.26 |
| 22    | 2.10 | 2.32 |
| 23    | 2.15 | 2.38 |
| 24    | 2.20 | 2.44 |
| 25    | 2.25 | 2.50 |
| 26    | 2.30 | 2.56 |
| 27    | 2.35 | 2.62 |
| 28    | 2.40 | 2.68 |
| 29    | 2.45 | 2.74 |
| 30    | 2.50 | 2.80 |
| 31    | 2.55 | 2.86 |

TABLE II.

Shewing the Rebate of one Pound for 31 Years, at 5 and 6 per Cent. Simple Interest.

| 5       | 6       |
|---------|---------|
| .952380 | .943396 |
| .909091 | .892857 |
| .869565 | .847457 |
| .833333 | .806451 |
| .800000 | .769230 |
| .769230 | .735294 |
| .740740 | .704225 |
| .714286 | .675675 |
| .689655 | .649350 |
| .666666 | .625000 |
| .645161 | .602409 |
| .625000 | .581395 |
| .606060 | .561797 |
| .588235 | .543478 |
| .571428 | .526315 |
| .555555 | .510204 |
| .540540 | .495049 |
| .526315 | .480769 |
| .512820 | .467289 |
| .500000 | .454545 |
| .487804 | .442477 |
| .476190 | .431034 |
| .465116 | .420168 |
| .454545 | .409836 |
| .444444 | .400000 |
| .434781 | .390625 |
| .425532 | .381679 |
| .416666 | .373134 |
| .408163 | .364963 |
| .400000 | .357143 |
| .393157 | .349650 |

## Simple Interest.

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In the Use of these Tables, the Proportion runs ;

As 1 : To the Tabular Number : : So the Sum of Money given : To the Answer sought. And seeing the first Number is an Unit, the whole Work requires only a single Multiplication, as in the Examples following may be seen.

### EXAMPLE.

In the Use of the first Table.

What will 20*l.* amount to, forborn 7 Years, at 6 per Cent. Simple Interest? *Answer* 28*l.* 8*s.*

Tabular Number answering 7 Years, and under 6 per Cent. in the first Table is

Multiply by

1.42

20

---

28.40

### EXAMPLE II.

What will 3*l.* 17*s.* 6*d.* amount to, forborn 21 Years, at 5 per Cent. Simple Interest? *Answer* 7*l.* 18*s.* 10*d.*  $\frac{1}{2}$

Tabular Number under 5 per Cent. and answering 21 Years,

is

2.05

Multiply by the Principal

3.875

---

1025

1435

1640

615

---

7.94375

### EXAMPLE III.

In the Use of the second Table.

What ready Money will pay a Debt of 28*l.* 8*s.* due 7 Years hence, at 6 per Cent. Simple Interest? *Answer* 20*l.*

Tabular Number against 7 Years, and under 6 per Cent. is

1.704225

Multiply by the Debt

28.4

---

2816900

5633800

1408450

---

19.9999900

112

EX-

## EXAMPLE IV.

What ready Money will pay a Debt of 12 *l.* 12 *s.* 6 *d.* due 20 Years hence, Rebate being allowed, at 5 per Cent. Simple Interest? *Answer* 6 *l.* 6 *s.* 3 *d.*

Tabular Number against 20 Years, and under 5 per Cent. is .500000

Multiply by the Debt 12.625

Product = 6.3125

And thus may any Question of this Nature be resolved, if the Time given be even Years; but if not, use the Propositions themselves, as was shewn before.

## S E C T. II.

But if your Question be concerning annual Rents, Payments, or Annuities to be bought or sold for some Time, then you are to consider it under these four Particulars:

*First*, The Annuity or Pension.

*Secondly*, The Time of Continuance.

*Thirdly*, The Rate of Interest.

*Fourthly*, The present Worth.

Any three of these being given, the fourth thence may be found, as in the four following Propositions may be seen.

## P R O P O S I T I O N I.

Annuity, Rate, and Time given, to find the present Worth?

## R U L E.

To the Square of the Time multiplied by the Rate, add the Double of the Time; from which subtract the Rate multiplied by the Time, the Remainder multiplied by the Annuity, and that Product divided by the Double of the Rate, multiplied by the Time *plus* 2, the Quotient is the present Worth.

## EXAMPLE I.

What is an Annuity of 20 *l.* per Annum clear Value, to be sold for 7 Years, worth in ready Money, Simple Interest being computed at 6 per Cent.? *Answer* 116 *l.* 6 *s.* 9 *d.*  $\frac{1}{4}$  *feri.*

Annuity 20 *l.* Time 7 Years, Rate .06.

*The*



# Simple Interest.

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## The Work.

|                 |       |        |               |
|-----------------|-------|--------|---------------|
|                 |       | 16.52  | .12           |
|                 |       | 20     | 7             |
| 49=Square Time. | 2.84) | 330.40 | (116.338 2.84 |
| .06=the Rate.   |       | 284    |               |
| 2.94            | .06   | 464    |               |
| 14              | 7     | 284    |               |
|                 |       | 1800   |               |
| 16.94           | .42   | 1704   |               |
| 42              |       | 960    |               |
|                 |       | 852    |               |
| 16.52           |       | 1080   |               |
|                 |       | 852    |               |
|                 |       | 2280   |               |
|                 |       | 2272   |               |
|                 |       | 8      |               |

## EXAMPLE II.

There is an Annuity of 12 l. 10 s. per Annum to continue 21 Years; what is it worth at 5 per Cent. Simple Interest? Answer 192 l. 1 s. 5 d.  $\frac{1}{2}$ .

Annuity 12.5 l. Time 21 Years, Rate .05.

## The Work.

|       |      |                      |
|-------|------|----------------------|
|       |      | 12.5 Annuity.        |
| 21    |      | 63                   |
| 21    |      | 375                  |
|       |      | 750                  |
| 21    | 21   | 4.1) 787.5 (192.0731 |
| 42    | 2    | 41                   |
|       |      | 377                  |
| 441   | 42   | 369                  |
| .05   |      | 85                   |
|       | 21   | 82                   |
| 22.05 | .05  | 300                  |
| 42    |      | 287                  |
|       | 1.05 | 130                  |
| 64.05 |      | 123                  |
| 1.05  |      | 70                   |
|       |      | 41                   |
| 63    |      | 29                   |

PROP.

## P R O P. II.

11. Present Worth, Time, and Rate given, to find the Annuity?

## R U L E.

Multiply the Double of the Rate multiplied by the Time plus 2, by the present Worth; that Product divided by the Square of the Time multiplied by the Rate, plus the Double of the Time, minus the Rate multiplied by the Time, the Quotient is the Annuity.

## E X A M P L E.

What Annuity to continue 7 Years at 6 per Cent. Simple Interest, will 20 l. purchase? *Answ.* 3 l. 8 s. 9 d.  $\frac{1}{4}$  ferè.  
Present Worth 20 l. Time 7 Years, Rate .06.

The Work.

|         |       |
|---------|-------|
| .12     |       |
| 7       |       |
| 2.84    | 49    |
| 20      | .06   |
| 16.52   | 2.94  |
| 56.80   | 14.   |
| (3.4382 |       |
| 4956    |       |
| 7240    | 16.94 |
| 6608    | .42   |
| 6320    | 16.52 |
| 4956    |       |
| 13640   |       |
| 13216   |       |
| 4240    |       |

## E X A M P L E II.

What Annuity, to continue 21 Years, will 192.0731 l. or 192 l. 1 s. 5 d.  $\frac{1}{4}$  purchase at 5 per Cent. Simple Interest?

Purchase Money 192.0731 l. Time 21 Years, Rate .05.

R U L E.

# Simple Interest.

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## RULE.

Purchase Money } 192.0731 } Multi-  
Product of the double of the Rate, } = 4.10 } ply.  
multiplied by the Time *plus* 2, is } 63) 7875 (12.5

Answer 12. 10s.

63  
—  
157  
126  
—  
315  
315  
—  
0

This is the Converse of *Question* the Second, and *Proposition* the First, foregoing.

## P R O P. III.

The Annuity, present Worth, and Time being given, to find the Rate of Interest.

## RULE.

The Product of the Annuity and Time, *minus* the present Worth, being multiplied by 2, and divided by the Sum of double the present Worth, multiplied by the Time, *plus* the Annuity multiplied by the Time, *minus* the Annuity multiplied by the Square of the Time, the Quotient is the Rate.

## E X A M P L E I.

At what Rate of Simple Interest will, 116.338, or 116l. 6s. 9d.  $\frac{1}{4}$  purchase an Annuity of 20l. to continue for 7 Years? *Ans.* 6 per Cent the Rate.

Ans.



Annuity 20*l.* present Worth 116.338, Time 7 Years.*The Work.*

|          |     |         |              |
|----------|-----|---------|--------------|
| 116.338  | 20  | 20      | 20           |
| 2        | 7   | 7       | 49           |
| 232.676  | 140 | 140     | 180          |
| 7        |     | 116.338 | 80           |
| 1628.732 |     | 23.662  | 980          |
| 140      |     | 2       |              |
| 1768.732 |     | 788.732 | 47.3240 (.06 |
| 980      |     |         |              |
| 788.732  |     |         |              |

## EXAMPLE II.

At what Rate of Simple Interest will 250*l.* purchase an Annuity of 30*l.* per Annum, to continue 10 Years?*Ans.* 4*l.* 6*s.* 11*d.*  $\frac{1}{2}$  ferè the Interest per Cent. sought.Annuity 30*l.* present Worth 250, Time 10 Years.*The Work.*

2300) 1000.0000 (.043478 per L. 1.

or L. 4.347 per Cent.

## PROP. IV.

Annuity, Rate, and present Worth being given, to find the Time of Continuance.

## RULE.

To the doubled Product of the present Worth, multiplied by the Rate, add the Product of the Annuity multiplied by the Rate, the Square of the Difference betwixt this last Sum (which we may call *A*) and double the Annuity (which may be called *B*) added to the octuple Product of the present Worth; Annuity and Rate multiplied one into another, the Square Root of this last Sum added to, or subtracted from, the former Difference, according as *A* was either greater or less than *B*; this last Sum or Difference, divided by double the Annuity, multiplied by the Rate, quotes the Time sought.

## EXAMPLE.

In what Time will 7 Pound per Annum pay a Debt of

120.4 or 120*l.* 8*s.* at 6 per Cent. Simple Interest?

I

An-

# Simple Interest.

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Annuity 7 l. Rate .06 l. Present Worth 120 l. 8 s.

Ans. In 25 Years.

*The Work.*  
 Present Worth 120.4      Annuity 7  
 Rate .06      Rate .06

Mult. by 2      Double of Ann. Rate  
 14.448  
 Add 42      56.448

14.868 = A  
 14.000 = B Double the Annuity.

.868 Difference. Present Worth 120.4  
 .868 Rate

6944      7.224  
 5208      7  
 6944      50.568

7534241  
 404544      Mult. by 8  
 Prod. 404544

405.297424 (20.132 = Root.  
 .868 = former Difference, = A.  
 greater than B.

401) 00529  
 401      21. Sum

4023) 12874.84 (25 Years T A  
 12069      168  
 40262) 80524      420  
 40262      420

Kk

PROP.

## PROP. V.

To the foregoing four Propositions we may add a fifth, which is by halving the Annuity, Time and Rate given, to find the Amount.

## RULE.

From the given Number of Years subtract an Unit, half of the Remainder, multiplied by the Product of the Rate and Time, and to this Product adding the Number of Years given, the Sum multiplied by the Annuity gives the Amount.

## EXAMPLE.

An Annuity of 20 l. per Annum is forborn 7 Years, what will then be due at 5 per Cent. Simple Interest? Annuity 20 l. Time 7 Years, Rate .05. Answer 161 l.

## The Work.

|         |        |         |     |
|---------|--------|---------|-----|
| 7       | Time—1 | .35     | .05 |
| 7       |        | 3       | 7   |
| 20.208  | 3      | 140.504 | .35 |
| 8       |        | 7       |     |
| 404.244 |        | 50.8    |     |
|         |        | 20      |     |
|         |        | 161.00  |     |

## EXAMPLE II.

A Tradesman binds his Son as Apprentice for 9 Years, and at the same time lets an Annuity of 36 l. 15 s. run to the Expiration of the said Term, that it may be a Stock for his Son. The Question is, What this Stock will be, accounting Simple Interest at 6 per Cent? Answer 303 l. 11 s. 1 d. 4 ferð.

The



| The Work. |          |                |
|-----------|----------|----------------|
| 7         | 7        | 36.75          |
| <u>00</u> | <u>1</u> | <u>8.20</u>    |
| .42       | 6        | 22050          |
| <u>3</u>  | <u>—</u> | 7350           |
| 1:26      | 3        | 29400          |
| <u>7</u>  | <u>—</u> | <u>3095550</u> |
| 8.26      |          |                |

The First, Second and Fifth Propositions being, of most common Use, we have annexed Tables fitted thereto, at 5 and 6 per Cent. as in the first Section, whereby the Answer may be found at one single Operation, as in the Use of them may be seen.

We need not say any thing of their Composition, the Propositions themselves being the Fountains whence they were drawn.

16A

| Years. | The present Worth of one Pound Annuities for 31 Years at 5 and 6 per Cent. Simple Interest. |           | The Annuity that one Pound will purchase for 31 Years, at 5 and 6 per Cent. Simple Interest. |         | Amount of 1 Pound Ann. for 31 Y. at 5 and 6 per C. Sim. Int. |       |
|--------|---------------------------------------------------------------------------------------------|-----------|----------------------------------------------------------------------------------------------|---------|--------------------------------------------------------------|-------|
|        | TABLE I.                                                                                    |           | TABLE II.                                                                                    |         | TAB. III.                                                    |       |
|        | 5                                                                                           | 6         | 5                                                                                            | 6       | 5                                                            | 6     |
| 1      | 0.952386                                                                                    | 0.943396  | 1.05                                                                                         | 1.06    | 1.00                                                         | 1.00  |
| 2      | 1.863636                                                                                    | 1.849285  | .536585                                                                                      | .543689 | 2.05                                                         | 2.06  |
| 3      | 2.739130                                                                                    | 2.694915  | .365079                                                                                      | .371069 | 3.15                                                         | 3.18  |
| 4      | 3.583333                                                                                    | 3.516129  | .279069                                                                                      | .284403 | 4.30                                                         | 4.36  |
| 5      | 4.400000                                                                                    | 4.307692  | .227272                                                                                      | .232142 | 5.5                                                          | 5.60  |
| 6      | 5.192307                                                                                    | 5.073529  | .192607                                                                                      | .197101 | 6.75                                                         | 6.90  |
| 7      | 5.962962                                                                                    | 5.816901  | .167702                                                                                      | .171913 | 8.05                                                         | 8.26  |
| 8      | 6.714285                                                                                    | 6.540540  | .148936                                                                                      | .152892 | 9.40                                                         | 9.68  |
| 9      | 7.448275                                                                                    | 7.246753  | .134259                                                                                      | .137992 | 10.80                                                        | 11.16 |
| 10     | 8.166666                                                                                    | 7.937500  | .122041                                                                                      | .125984 | 12.25                                                        | 12.70 |
| 11     | 8.870967                                                                                    | 8.614457  | .114545                                                                                      | .116084 | 13.75                                                        | 14.30 |
| 12     | 8.562500                                                                                    | 8.279069  | .104575                                                                                      | .107738 | 15.30                                                        | 15.96 |
| 13     | 10.242424                                                                                   | 9.932584  | .097633                                                                                      | .100678 | 16.90                                                        | 17.68 |
| 14     | 10.911764                                                                                   | 10.853260 | .091644                                                                                      | .092184 | 18.55                                                        | 19.46 |
| 15     | 11.571428                                                                                   | 11.210526 | .086420                                                                                      | .089207 | 19.25                                                        | 21.30 |
| 16     | 12.222222                                                                                   | 11.836734 | .081818                                                                                      | .084482 | 22.00                                                        | 23.20 |
| 17     | 12.864864                                                                                   | 12.455445 | .077731                                                                                      | .080286 | 23.80                                                        | 25.16 |
| 18     | 13.500000                                                                                   | 13.067067 | .074074                                                                                      | .076527 | 25.65                                                        | 27.18 |
| 19     | 14.128205                                                                                   | 13.672897 | .070780                                                                                      | .073137 | 27.55                                                        | 29.26 |
| 20     | 14.750000                                                                                   | 14.272727 | .068644                                                                                      | .070063 | 29.50                                                        | 31.40 |
| 21     | 15.365853                                                                                   | 14.865044 | .065079                                                                                      | .067262 | 31.50                                                        | 33.60 |
| 22     | 15.976190                                                                                   | 15.456896 | .062593                                                                                      | .064697 | 33.55                                                        | 35.86 |
| 23     | 16.581393                                                                                   | 16.042016 | .060308                                                                                      | .062336 | 35.65                                                        | 38.18 |
| 24     | 17.181818                                                                                   | 16.602459 | .058201                                                                                      | .060158 | 37.80                                                        | 40.56 |
| 25     | 17.777777                                                                                   | 17.200000 | .056255                                                                                      | .058139 | 40.00                                                        | 43.00 |
| 26     | 18.369565                                                                                   | 17.173437 | .054438                                                                                      | .056263 | 42.25                                                        | 45.50 |
| 27     | 18.957447                                                                                   | 18.343511 | .052749                                                                                      | .054515 | 44.55                                                        | 48.06 |
| 28     | 19.541666                                                                                   | 18.910447 | .051172                                                                                      | .052880 | 46.90                                                        | 50.68 |
| 29     | 20.122449                                                                                   | 19.472627 | .049695                                                                                      | .051349 | 49.30                                                        | 53.36 |
| 30     | 20.700000                                                                                   | 20.035714 | .048309                                                                                      | .049911 | 51.75                                                        | 56.10 |
| 31     | 21.274510                                                                                   | 20.594404 | .047005                                                                                      | .048556 | 54.25                                                        | 58.90 |

The Use of these Tables is the same with those above-going, as in the following Examples may be seen.

## EXAMPLE I.

In the Use of the first Table:

There is an Annuity of 20 *l. per Annum* to continue for 7 Years, to be sold for ready Money, what is the Value thereof, allowing Simple Interest at 6 *per Cent*?

Tabular Number, answering 7 Years, and under 6 *per Cent*.

In the first Table is

5.816901

Multiply by

20

Answer 116 *l.* 6 *s.* 9 *d.*  $\frac{1}{2}$  *ferè.* 116.338020

This agrees with Example the First, in the first Proposition of this Section.

*Nota*, But if this were wrought by the common Tables of Simple Interest, shewing the present Worth of Annuities, printed in several Books of Arithmetick, the Answer would be found to be 113 *l.* 19 *s.* 6 *d.* 3 *q.* *ferè.* So, if their Tables be true, he that gives 116 *l.* 6 *s.* 9 *d.*  $\frac{1}{2}$ , is cheated of 2 *l.* 7 *s.* 2 *d.*  $\frac{1}{2}$ ; but this we will try.

*A* lends *B* 113 *l.* 19 *s.* 6 *d.*  $\frac{1}{2}$  for 7 Years, which at the End thereof amounts to 161 *l.* 16 *s.* 11 *d.*  $\frac{1}{2}$ ; this is not deny'd. At the same time *B* delivers up to *A* an annual Rent of 20 *l. per Annum*, to continue the same Term, and accordingly received it annually. Now the Question is, whether the Reception of these 7 annual Payments quit the Scores betwixt *A* and *B*, both being obliged under the same Rate of Interest, for by their Tables it must; but it may appear to any considerate Man it doth not; which I prove thus:

| Years.                                 |   |     |       |
|----------------------------------------|---|-----|-------|
| If 100 <i>l.</i> paid before it be due | 6 | 136 | 27.20 |
|                                        | 5 | 130 | 26.00 |
|                                        | 4 | 124 | 24.80 |
|                                        | 3 | 118 | 23.60 |
|                                        | 2 | 112 | 22.40 |
|                                        | 1 | 106 | 21.20 |
|                                        | 0 | 100 | 20.00 |

be worth what 20 *l.* facit

Sum is 165.20

Thus



Thus you may see the 7 annual Payments are worth; at the End of 7 Years, 165 *l.* 4 *s.* and the whole Amount that *A* could claim of *B* was but 161 *l.* 16 *s.* 11 *d.*  $\frac{1}{4}$ ; therefore *A* is in *B*'s Debt 3 *l.* 7 *s.* 0 *d.*  $\frac{1}{4}$ .

But by this Table of ours, if *A* had lent to *B* 116.338 or 116 *l.* 6 *s.* 9 *d.*  $\frac{1}{4}$ , it would upon the Condition aforesaid, have amounted to 165.2 or 165 *l.* 4 *s.* whereby it is evident our Table is founded on a firm Foundation. See *Dary* in his Interest Epitomized.

## EXAMPLE II.

An Annuity of 51 *l.* 15 *s.* to continue 21 Years is to be sold for ready Money, what is it worth at 5 per Cent. Simple Interest? *Answer* 795 *l.* 3 *s.* 8 *d.* *ferd.*

Tabular Number answering 21 Years, and under 5 per Cent. in the first Table, is 15.365853  
Multiply by 51.75

$$\begin{array}{r} 76829265 \\ 107560971 \\ 15365853 \\ 76829265 \\ \hline 795.18289275 \end{array}$$

## EXAMPLE III.

In the Use of the second Table.

What Annuity to continue 7 Years, will 20 *l.* purchase at 5 per Cent. Simple Interest? *Answer* 3 *l.* 7 *s.* 1 *d.* *ferd.*

Tabular Number answering 7 Years, and under 5 per Cent. in Table the Second, is .167702  
Multiply by 20

$$\begin{array}{r} 3.354040 \end{array}$$

## QUEST. II.

What Annuity, to continue 21 Years, will 65 *l.* 10 *s.* purchase at 6 per Cent. Simple Interest?

Tabular

1.677  
1075  
1036

# Simple Interest

8257

Tabular Number answering 21, and under 6 per Cent. in the second Table, is

Multiply by

.067262

65.5

336310

336310

403572

Answer 4 l. 8 s. 1 d. 4

4.4056610

## EXAMPLE I

In the Use of the third Table.

An Annuity of 20 l. per Annum is forborn for 7 Years; what will then be due at 5 per Cent. Simple Interest?

Answer 161 l.

Tabular Number answering 7 Years, and under 5 per Cent. in the third Table, is

8.05

20

161.00

## EXAMPLE II

What will an Annuity of 36 l. 11 s. 3 d. amount to, forborn 21 Years at 6 per Cent. Simple Interest? Answer 1228 l. 10 s. 3 d.

Tabular Number answering 21 Years, and under 6 per Cent. in Table the Third, is

33.60

Multiply

36.5625

By

33.6

2193750

1096875

1096875

1228.50000

Thus may any other Question be resolved if the Time given be even Years, not exceeding 31 Years, and the Rate either 5 or 6 per Cent. If otherwise, you must use the Propositions themselves.

Here

I

Here follow some more Questions for the Use of the said Tables, wherein appears some more Variety.

QUEST. I.

*A* hath an Annuity of 20*l.* per Annum to continue 7 Years. *B* hath an Annuity of 5*l.* 10*s.* to continue 21 Years. These two Persons would change Annuities, and allow each other Simple Interest at 6 per Cent. The Question is, who must pay Money, and how much? Answer, *A* must receive from *B* 34*l.* 11*s.* 7*d.*  $\frac{1}{2}$  on the Conditions aforesaid.

Seek by Table the First, in the second or last Head of Tables, the present Worth of 20*l.* per Annum to continue 7 Years, which you may see by the Work will be 116*l.* 6*s.* 9*d.*  $\frac{1}{4}$ .

$$\begin{array}{r} 5.816001 \\ 20 \\ \hline A = 116.338020 \end{array}$$

Seek likewise by the same Table, the present Worth of 5*l.* 10*s.* per Annum to continue 21 Years, which by the Work you may see will be 81*l.* 15*s.* 1*d.*  $\frac{1}{4}$ .

$$\begin{array}{r} 14.865044 \\ 5.5 \\ \hline 74.385220 \\ 74325220 \\ \hline B = 81.7577420 \\ \text{l. s. d. q.} \\ \text{From } 116 : 06 : 9 : 1 \\ \text{Sub. } 81 : 15 : 1 : 3 \\ \hline \text{Rest } 34 : 11 : 7 : 2 \end{array}$$

QUEST. II.

*A* lends to *B* 300*l.* upon a Mortgage of Land, whose Rent is 7*l.* per Ann. *B* keeps his Money 5 Years, during which time *A* receives the said Rent; at the End of which



# Simple Interest.

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which Time they come to Account. The Question is, whether this Rent hath cleared the Mortgage; if not, what must *B* pay to *A*, Simple Interest, at 6 per Cent. being accounted on both Sides?—

First, Seek by the first Table in the former Head of Tables, the Amount of 360 *l.* to continue 5 Years at 6 per Cent. Simple Interest, which you will find to be 468 *l.*

1.30  
360

78

39

468.00

Secondly, Seek by Table the Third in the second Head of Tables, what an Annuity of 75 *l.* per Annum will amount to, forborn 5 Years at 6 per Cent. Simple Interest, which you will find to be 420 *l.* which *B* must pay unto *A* before he have discharged his Mortgage.

5.60

75

2800

3920

420.00

## QUEST. III.

A Merchant is indebted 360 *l.* the Creditor is contented to receive the same at 10 equal yearly Payments, the Debtor allowing for the Forbearance of the same Money after the Rate of 6 per Cent. Simple Interest. The Question is, what those Payments ought to be? Answer, 45 *l.* 7 *s.* 1 *d.*

Seek in the second Table of the last Head of Tables for the Numbers over-against 10 Years, and under 6 per Cent. which Number multiplied by 360, gives the Answer.

L 1

See

## Simple Interest.

*See the Work.*

.125984

360

755904

377952

45.354240

## QUEST. IV.

A Gentleman bequeathed 1500 *l.* to his Daughter to be paid her at 14 Years End. The Executors desire to pay ready Money, so they may be abated after the Rate of 5 *per Cent.* Simple Interest. The Question is, what ready Money will pay this Legacy? *Answer*, 882 *l.* 7 *s.* 0 *d.*  $\frac{1}{2}$ .

Seek in the second Table in the first Head of Tables, for the Number over-against the 14th Year, and under 5 *per Cent.* which multiplied by 1500 gives the Answer.

*The Work.*

.588235

1500

2941175

588235

882.352500

## QUEST. V.

A Gentleman hath 160 *l.* which he would lay out to purchase 20 *l.* *per Annum.* How many Years must the said Annuity continue, Simple Interest being computed at 6 *per Cent.*?

*First*, Divide 160 by 20, quotes 8, which shews he gives 8 Years Purchase for the said Annuity.

*Secondly*, Seek in the first Table of the last Head of Tables, and under 6 *per Cent.* for the Number 8; but not finding it, I look the next less, which is 7.937500, and over-against it is 10 Years, which shews it must continue somewhat above 10 Years; and to find what, say, As the Difference betwixt this and the next bigger Number

ber .676957 : To 1 :: So the Difference of the said next less and 8 (viz.) .0625 : To .092 Parts of a Year, equal to 1 Month and 5 Days, accounting 13 to the Year. So his Annuity must continue 16 Years, 1 Month, and 5 Days.

Let these suffice in this Place.

We should now proceed to *Compound Interest* and *Annuities*; but these Things being best performed by *Logarithms*, we will therefore treat of them when we come into *Logarithmical Arithmetick*.

We shall now proceed to other Parts of *Arithmetick*, as *Tret* and *Tare*, *Barter*, *Fellowship*, &c.

### Rules in Tret and Tare, &c.

**T**HESSE are Allowances commonly used among Merchants, in such Commodities as are sold by Weight.

*Tare* is the Weight of the Bag, Chest, Hoghead, &c. wherein the Goods are carried or put.

*Tret* is an Allowance of 4 lb. in 100, or 104 lb. for Goods, wherein is Loss, as *Treacle*, *Sugar*, &c.

*Cloff* is an Allowance of 2 Pound upon every Draught which exceedeth 300 Gros Weight.

*Subtile* is the Weight of the Goods when the *Tare* is subtracted, but not the *Tret*.

*Neat Weight* is the Remainder when both (if both be allow'd) are taken away.

### QUESTION I.

In 6 Bags of Raisins, marked with the Gross Weight, as followeth, *Tare* 20 Pound per Bag, what *Neat Weight*?

L 1 2

First,



First, Multiply 20, the Weight of each Bag, by 6 The Number of Bags produced 120, which divided by 112 gives 1 C. 0 q. 8 lb. which subtracted from the Gross, gives the Neat Wt.

|     |    |    |     |                       |
|-----|----|----|-----|-----------------------|
|     | C. | q. | lb. |                       |
| 20  |    |    |     | 47 0 05 Gross Wt.     |
| 6   |    |    |     | Sub. 1 0 8 Tare.      |
| —   | C. | q. | lb. |                       |
| 112 | 1  | 0  | 8   | Ans. 45 3 25 Neat Wt. |
| 112 |    |    |     |                       |
| —   |    |    |     |                       |
| 8   |    |    |     |                       |

QUEST. II.

In 346 C. 3 q. 12 lb. Gross, Tare 12 lb. per C. how many C. Neat?

First find the Pounds Gross,

|          |    |     |                          |
|----------|----|-----|--------------------------|
| C.       | q. | lb. | To find the Tare.        |
| Thus 346 | 3  | 12  | lb. lb. lb.              |
| 4        |    |     | Say if 112 : 12 :: 38848 |
|          |    |     | 12                       |

|                |                    |
|----------------|--------------------|
| 1387 Quarters. |                    |
| 28             | 77686              |
| 11098          | 38848              |
| 2775           | 112 466176 (4161 = |
|                | the Tare.          |

|                              |     |
|------------------------------|-----|
| 38848 lb. Gross.             |     |
| 4162 Tare Sub.               | 448 |
| C. q. lb.                    | 181 |
| 112 34686 (309 2 22 Neat Wt. | 112 |

|                         |     |
|-------------------------|-----|
| 336                     | 697 |
| 1086                    | 672 |
| 1008                    | 256 |
| 78 lb. = to 2 q. 22 lb. | 224 |
| Rem. 32 Inconfid.       |     |

QUEST.

# Take and Tret.

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## QUEST. III.

In 674 C. 2 q. 16 lb. Gross Weight, Tare 14 lb. per C. what Neat Weight?

G. q. lb. 674 2 16 Gross Wt.  
84 1 9 Tare.  
590 1 7 Neat Wt.

When Tare, as here is an Aliquot Part of 112, take such Part of the Gross Weight; which subtracted from the Gross, leaves the Neat Weight, as in the Example I take  $\frac{1}{8}$  Part for 14 lb.

Any Aliquot Part is shewn in the annexed Table.

The Tare in the second Question might have been found more quickly, as in the following Question, where the Tare is no Aliquot Part of 112.

## QUEST. IV.

In 246 C. 2 q. 16 lb. Gross, Tare 21 lb. per C. how many Hundred Neat? Ans. 206 C. 1 q. 16 lb.  $\frac{1}{2}$ . Reduce the Gross into Pounds thus,

To find the Tare. Here to find the Tare I multiply the Gross C. by 21, and for the 2 Quarters I took  $\frac{1}{4}$  of the 21 Pound; and because 16 is  $\frac{2}{3}$  of 112, I took  $\frac{2}{3}$  of 21, which is 3, which added is the Tare, as in the Work.

27624 lb. Gross  
5179  $\frac{1}{2}$  Tare

112) 22444  $\frac{1}{2}$  (200 1 16  $\frac{1}{2}$  Neat Wt.

224  
044 = 1 16.

The

The last Question may be answered as in the annexed Work; for though 21 lb. is not an Aliquot Part of 112 lb. it may be parted into Aliquot Parts (*viz.*) 14 and 7. For 14 lb. take  $\frac{1}{8}$  Part, and for 7 lb. take  $\frac{1}{2}$  of 14; those two added together give the Tare, which subtracted from the Gross, leaves the Neat Weight as before. Thus you may do in many Cases, which the Learner should observe.

C. q. lb.  
246 2 16 Gross Wt.

$\frac{1}{8}$  30 3 9 } Tare.  
15 1 18 $\frac{1}{2}$

Sub. 46 0 27 $\frac{1}{2}$

200 1 16 $\frac{1}{2}$  Neat Wt.

## QUEST. V.

In 72 C. 3 q. 12 lb. Gross, Tare 16 lb. per C. Tret 4 lb. per 104, how many C. Neat?

C. q. lb.

The Tare is found as before, which subtracted from the Gross, leaves the Subtile,

$\frac{1}{8}$  72 3 12 Gross Wt.  
10 1 18 Tare.

which I divide by 26, which is  $\frac{1}{4}$  of 104 quotes the Tret,

$\frac{1}{26}$  62 1 22 Subtile.  
2 1 17 Tret.

which taken from the Subtile, leaves the Neat Weight.

60 0 05 Neat Wt.

## QUEST. VI.

In 6 Hogsheads of Tobacco, containing 56 C. 2 q. 20 lb. Gross, Tare 30 lb. per Hoghead, 4 lb. per 104 Tret, and 2 lb. upon every 336 Gross Weight for Cloff; what will the Neat Weight cost at 6 d.  $\frac{1}{2}$  per Pound; 51 l. 11 s. 8 d. being deducted for Custom and other Charges? Answer, 108 l. 11 s. 9 d.

See the following Work.



# The Rule of Barter.

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## The Work.

|               |                                   |                                |
|---------------|-----------------------------------|--------------------------------|
| lb.           | Mul. 30                           | 336) 5931 (17—the Cloff.       |
| 112           | By 6                              |                                |
| 56            | —                                 | 336                            |
| —             | 180 Tare.                         | —                              |
| 672           | —                                 | 2571                           |
| 560           | 26) 6168 (237 $\frac{1}{3}$ Tret. | 2352                           |
| 56            | 52                                | —                              |
| 20            | —                                 | 219                            |
| —             | 96                                | —                              |
| 6348 Gros.    | 78                                | At 6 d. $\frac{1}{2}$ Wt. 5914 |
| 180 Tare.     | —                                 | —                              |
| —             | 188                               | 2957                           |
| 6168 Subtile. | 182                               | 246.5                          |
| 237 Tret.     | —                                 | —                              |
| —             | 6                                 | s. 320   3.5 d.                |
| 5931          | —                                 | L. 160. 3.5                    |
| 17 Cloff.     | —                                 | 51. 11.8                       |
| —             | —                                 | —                              |
| 5914 Neat.    | —                                 | Ans. L. 108. 11.9              |

2<sup>nd</sup> March.

# The Rule of BARTER.

**B**ARTER is a Rule by which Merchants or others exchange Goods of several Prices and Quantities, so as to receive no Loss by such Truck or Change.

Observe the Nature and Work of the following Questions.

## QUESTION I.

How many Pound of Sugar at 4 d.  $\frac{1}{2}$  per Pound, must be given in Barter for 60 Gros of Inle at 8 s. 8 d. per Gros?

First, By Practice find the s. d.

Value of the 60 Gros of At 8 : 8 Gros, Wt. 60 Gro. Inle at 8 s. 8 d. per Gros,

which will be 26 l. which

divided by the Decimal of 4 d.  $\frac{1}{2}$ , which is .01875, quotes 1386  $\frac{2}{3}$ , the Number of Pounds sought.

Facit 26 l.

.01875)

.01875) 26.00000 (1386.666

1875      At 4 d.  $\frac{1}{2}$  lb. We.      1386 $\frac{2}{3}$ 

7250

3625

16250

15000

12500

11250

11250

Proof.

|    |    |   |
|----|----|---|
| 17 | 6  | 6 |
| 8  | 13 | 3 |
|    |    | 3 |
| 26 | 00 | 0 |

Or the last Question may be wrought thus: Bring the Price of a Gross (*viz.* 8 s. 8 d.) into Pence, which will be 104; then say,

If 4 d.  $\frac{1}{2}$  or 4.5 become 104 d. what will 60 become; *Facit* 1386 $\frac{2}{3}$  as before.

But you may observe the Terms are not methodically stated; but because the 3d multiplied by the 2d, and divided by the 1st, gives the true Answer, we have so placed the Numbers: The Reader therefore is to consider such Cases, that he be at no Loss; for the Reason is evident.

## QUEST. II.

A hath 2 Packs of Cotton-Wool at 240 lb. per Pack, and at 15 d. per Pound ready Money; in Barter he will have 16 d.  $\frac{1}{2}$ . B hath broad Beds at 5 s. per Yard ready Money. The Question is, to know how B must raise his Beds in Barter per Yard, that he be no Loser, and how many Yards will be equivalent to the 2 Packs of Cotton?

Find first how much he must raise his Beds in Barter; thus, if 15 d. becomes 16 d.  $\frac{1}{2}$ , what will 5 s. ? *Facit* 5 s. 6 d. this done, at 16 d.  $\frac{1}{2}$  per lb. what will 2 Packs, or 480 lb. cost? And Note, that as many Pence as the Pound costs, so many Pounds will the Pack cost. So the 2 Packs will cost 33 Pounds: Then, as in the last Question, divide 33 by the Decimal of 5 s. 6 d. (*viz.*) .275, quotes 120, the Number of Yards sought.

See

# The Rule of Barter.

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See the Work.

First, if  $15 : 16.5 :: 5$ .

$$\begin{array}{r} \text{d.} \quad \text{d.} \quad \text{s.} \\ 15) 82.5 \quad (5.5 \quad \text{Facit } 5 \text{ s. } 6 \text{ d.} \\ \underline{75} \\ 75 \\ \underline{75} \\ 75 \\ \underline{75} \\ 0 \end{array}$$

Secondly, .275) 33,000 (120 Yards.

$$\begin{array}{r} \text{275} \\ \underline{275} \quad \text{At } 5 \text{ s. } 6 \text{ d. Yd. Wt.} \quad 120 \\ 550 \\ \underline{550} \quad \text{Facit } 33 \end{array}$$

o Proof.

## QUEST. III.

A hath 100 Yards of Kersey at 3 s. per Yard ready Money, which he bartereth with B at 3 s. 6 d. taking small Hair Buttons at 15 d. per Gross, which are but worth 12 d. How many Gross of Buttons will pay for the Kersey; and whether doth A or B get the better Bargain; and by how much?

First, at 3 s. 6 d. per Yard what 100 Yards?

$$\begin{array}{r} 100 \\ \underline{100} \\ 12.5 \\ \underline{5.0} \\ \text{Facit } 17.5 \text{ or } 17 \text{ l. } 10 \text{ s.} \end{array}$$

M m

Secondly,



Secondly. .0625) 17.5000 (280 Numb. of Gr. sought.

1250

5000

5000

0

Thirdly, At 3s. Yd. Wt. 100

10

5

Facit 15 A.

Fourthly, At 12d. Gr. what 280

14 B.

A's Goods are worth 15 l. and B's Goods worth 14 l. by which it is evident B gets the better Bargain by 1 Pound, or 20 Shillings.

But if it were required to know how much *per Cent.* B hath the better Bargain; then say, if 14 l. become 15 l.

what will 100 l. become? *Ans.* 107.142 or 7.142, the Gain *per Cent.*

100 (107.142) 107.142  
100 (107.142) 107.142  
100 (107.142) 107.142  
100 (107.142) 107.142  
100 (107.142) 107.142  
100 (107.142) 107.142  
100 (107.142) 107.142  
100 (107.142) 107.142  
100 (107.142) 107.142  
100 (107.142) 107.142

100

98

20

14

60

56

QUEST.

QUEST. IV.

*A* hath Linen Cloth at 10 *d.* the Ell ready Money, in Barter 12 *d.* *B* hath 3610 Pound of Sugar at 7 *d.* the Pound ready Money, and would have of *A* 35 *l.* in ready Money, the rest in Linen Cloth. The Question is, What Rate the Sugar bears in Barter, and how much Linen Cloth *A* must give unto *B*?

It is evident that as much Sugar as *B* receives ready Money for, which is 35 Pounds worth, he ought but to have 7 *d.* per Pound for it.

However, first find the Barter thus; If 10 *d.* : 12 *d.* :: 7 *d.* : facit 8  $\frac{4}{5}$ . Then find the Quantity of Sugar *A* must have for his 35 *l.* Thus if  $\frac{4}{5}$  : 1 :: 35 : facit 1200 *lb.* of Sugar; which subtract from 3610, resteth 2410, which at 8 *d.*  $\frac{4}{5}$  the Pound, will amount to 84 *l.* 7 *s.* or 84.35; which divided by the Decimal of 1 Shilling, viz. .05, gives 1687, the Quantity of Linen Cloth, in Ells, which was required.

The Rate the Sugar bears in Barter is 8.4, *B* must receive 1687 Ells of Linen Cloth, and 35 *l.* in ready Money.

QUEST. V.

Two Merchants barter, *A* hath 20 Hundred of Cheefe at 21 *s.* 6 *d.* the Hundred, *B* hath 8 Pieces of Irish Cloth at 3 *l.* 14 *s.* per Piece. The Question is, whether must receive Money, and how much? *Ans.* *A* must pay to *B* 8 *l.* 2 *s.*

First, Say, at 21 *s.* 6 *d.* the *C.* what 20 *C.*?

*Ans.* 21 *l.* 10 *s.* *A*'s Goods.

Facit 21 10

Secondly, Say, at 3 *l.* 14 *s.* per Piece, what 8 Pieces?

|                |                       |      |
|----------------|-----------------------|------|
| <i>Ans.</i> 29 | 12 <i>B</i> 's Goods, | 24   |
| Sub. 21        | 10                    | 4    |
|                |                       | 1 12 |

Rest. 8 2

Facit 29 12

## QUEST. VI.

*A* barter with *B* Silk Stockings at 30 s. per Pair, which are vendible but for 26 s. and would have  $\frac{1}{3}$  ready Money, and again 10 l. per Cent. for Stuff at 2 s. per Yard ready Money: How must the Yard of Stuff be valued to equal the Barter?

*First*, I say, if  $100 : 110 :: \text{what } 30 \text{ l.}$  *Facit* 33 s.  

$$\begin{array}{r} 100 \quad 110 \quad 30 \\ 100 \quad 110 \quad 30 \\ \hline 33.00 \end{array}$$

Then, because *A* would have  $\frac{1}{3}$  in ready Money, the Barter only resteth in the  $\frac{2}{3}$ , which is the Remainder: Wherefore subtract  $\frac{1}{3}$  of 33, which is 11. from the true Price 26, resteth 15, and from itself, to wit 33, leaves 22. Then say,

If 15 : 22 :: 4 *Ans.* at 5 s.  $\frac{1}{3}$

$$\begin{array}{r} 15 \quad 22 \quad 4 \\ 15 \quad 22 \quad 4 \\ \hline 13 \end{array}$$

## QUEST. VII.

*A* barter with *B* Cloves at 6 s. for 7 s. 6 d. per Pound, and is willing to lose 10 l. per Cent. to have  $\frac{1}{3}$  ready Money: What's the just Price of a Yard of Velvet deliver'd at 22 s. to equal the Barter?

*First*, Say, If  $100 : 90 :: 7.5$   

$$\begin{array}{r} 100 \quad 90 \quad 7.5 \\ 100 \quad 90 \quad 7.5 \\ \hline 450 \\ 630 \\ \hline 6.750 \end{array}$$

*Facit* 6 s. 9 d.

Next,



## The Rule of Fellowship. 271

Next for  $\frac{1}{2}$  ready Money, which he desires, abate from 7 s. and 6 d. the Bartering Price,  $\frac{1}{2}$  thereof, which is 2 s. 6 d. rest 5 s. Then take 2 s. 6 d. from 6 s. 9 d. rest 4 s. 3 d.

Then say, If 5 : 425 :: 22

22

850

850

5) 93.50 (18.7 equal to the just Price of  
a Yard of Velvet,

5

43

40

35

35

00

## The Rule of FELLOWSHIP.

**T**HE *Rule of Fellowship* is for Merchants or other Traders, where they have joint Stocks in Company, to distribute unto every one his proportional Share of the Gain or Loss, according to his Stock laid out.

It is divided into two Parts, commonly called the *single* and *double Rule of Fellowship*, of which in their Order.

In the *single Rule*, having the particular Stocks, and the whole Gain or Loss, to find each particular Gain or Loss, observe this general Rule ;

As the total Sum of the Stocks :

To the total Gain or Loss ::

So each Man's particular Stock :

To each Man's particular Gain or Loss.

272 *Single Rule of Fellowship.*

**QUEST. I.**

Three Merchants put in Money together, *A, B* and *C*;  
*A* put in 20 *l.* *B* put in 30 *l.* *C* put in 40 *l.* they gained  
 180 *l.* what is each Man's Part of the Gain?

*A* 20

*B* 30 the total Sum 90 *l.* Gain 180 *l.*

*C* 40

Sum 90

Then say,

*First*, For *A*'s Share; If 90 : 180 :: 20

$$\begin{array}{r} 20 \\ 90 \overline{) 3600} \text{ (40 for } A. \\ \underline{360} \end{array}$$

*Secondly*, For *B*'s Share; If 90 : 180 :: 30

$$\begin{array}{r} 30 \\ 90 \overline{) 5400} \text{ (60 for } B. \\ \underline{540} \end{array}$$

*Thirdly*, For *C*'s Share; If 90 : 180 :: 40

$$\begin{array}{r} 40 \\ 90 \overline{) 7200} \text{ (80 for } C. \\ \underline{720} \end{array}$$

Sum 180 for Proof.

But if you consider the Observation belonging to the  
 Question, in the *Rule of Three*, you may contract your  
 Work in this and the like Questions, as was there inti-  
 mated; for if you divide your second Number 180 by your  
 first Number 90 and by the Quotient 2, multiplying *A, B*  
 and

# Single Rule of Fellowship. 273

and C's Stock (*viz.*) 20, 30, 40, produceth 40, 60, 80,  
A, B and C's Gains.

*See the Work.*

|                |                |                |
|----------------|----------------|----------------|
| 90) 180 (2     | Mult. 20 l.    | Mult. 30       |
| 180            | By 2           | By 2           |
| 0              | 40 = A's Gain. | 60 = B's Gain. |
|                | A's 40 Gain.   | B's 60 Gain.   |
| Mult. 40       |                | C's 80 Gain.   |
| By 2           |                |                |
| 80 = C's Gain. |                | 180            |

But if you consider this Question, the Answer may more quickly be found yet; for seeing the Gain was double to the whole Stock, each Man's Gain will be double to his Stock, and such Considerations as these may be of good Use in many Cases.

## QUEST. II.

A Chapman breaking, owes unto four Men the following Sums of Money, *viz.*

|        |     |    |    |                                                                                                                                      |
|--------|-----|----|----|--------------------------------------------------------------------------------------------------------------------------------------|
|        | l.  | s. | d. |                                                                                                                                      |
| To { A | 21  | 9  | 8  | His whole Estate is found to be<br>but 148 l. 2 s. 6 d. What<br>must each have of the same,<br>and what will it be <i>per</i> Pound? |
| B      | 72  | 19 | 3  |                                                                                                                                      |
| C      | 114 | 13 | 9  |                                                                                                                                      |
| D      | 264 | 17 | 6  |                                                                                                                                      |
| Sum    | 474 | 00 | 0  |                                                                                                                                      |

If you work this Question the contracted Way, the Quotient will be the Answer *per* Pound, to wit 6 s. 3 d.

*See*



See the whole Work.

474) 148.125 (.3125 = 6 s. 3 d. what each must have per Pound.

1422

592 Reduce the broken Part of each Man's  
 474 Money into Decimals, which multiplied by  
 .3125, gives in the several Products what  
 1185 each must have.

948

2370

2370

0

Mult. 114.6875 Mult. 72.9625 Mult. 21.475  
 By .3125 By .3125 By .3125

5734375

3648125

107375

2293750

1459250

42950

1146875

729625

21475

3440625

2188875

64425

C = 35.83984375 B = 22.80078125 A = 6.7109375

Mult. 264.875

l.

L s. d. q.

By .3125

A = 6.7109375 = 6 : 14 : 2 : 2

B = 22.80078125 = 22 : 16 : 0 : 0

1324375

C = 35.83984375 = 35 : 16 : 9 : 3

529750

D = 82.7734375 = 82 : 15 : 5 :

264875

794625

Proof 148.12500000 = 148 : 02 : 6 : 0

D = 82.7734375

## QUEST. XL

A, B and C put in Money together, A put in 20 l. B  
 and C put in 85 l. they gained 63 l. of which B took up  
 21 l. What did A and C gain, and B and C put in?

First,

# Single Rule of Fellowship. 275

First, Find *A*'s Gain, thus: If 105, the Sum of all Stocks, gain 62 l. what will 20 l. *A*'s Stock gain? Facit 12 l. for *A*'s Gain.

Secondly, Find *B*'s Stock, thus; if 12 l. which is *A*'s Gain, come from 20 l. *A*'s Stock; what will 21 l. come from, which is *B*'s Gain? Facit 35 l. which is *B*'s Stock; then *C*'s Stock must be the Remainder to 85 l. 50 l. And if you subtract *A* and *B*'s Gain, 33 from the whole Gain, 63, rests 30 for *C*'s Gain.

## QUEST. IV.

*A*, *B* and *C* put in Money together; *A* put in 20 l. *B* 30 l. *C* a Sum unknown; they gained 36 l. *C* took up 16 l. what did *A* and *B* gain, and *C* put in?

Subtract *C*'s Gain, 16 l. from the whole Gain 36 l. resteth 20 l. Then say, If 50 l. *A* and *B*'s Stock, gain 20, what will *A*'s Stock, 20 l. gain? Facit 8 for *A*, then *B* must have 12. To find *C*'s Stock, say, If 8 Pound, which is *A*'s Gain, come from 20, what will 16 l. *C*'s Gain come from? Facit 40 l. which *C* put in.

## QUEST. V.

*A*, *B* and *C* put in 360 l. and gained 276 l. of which as oft as *A* took up 3 l. *C* took up 5 l. and as oft as *C* took up 5 l. *B* took up 7 l. What did each gain, and put in?

Suppose some Number for *A*, that the rest of the Parts may be taken without Fractions. As suppose *A* had 9 l. then *B* must have 15 l. and *C* 21 l. whose Sum is 45.

Then the Proportion is, As 45 : To 270, So :: 15 : To 90  
9 54  
15 90  
45 126

But you had better find a common Multiplier, as in the contracted Way.

|                                                                                                                                                                                             |                                                                                                                                                                                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>45) 360 (8=Com. Mult.</p> <div style="text-align: right; margin-right: 20px;">             360<br/> <hr style="width: 50px; border: 0.5px solid black;"/>             0           </div> | <p>45) 270 (6=Com. Mult.</p> <div style="text-align: right; margin-right: 20px;">             270<br/> <hr style="width: 50px; border: 0.5px solid black;"/>             0           </div> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

78309

N n

Then

# 276 Single Rule of Fellowship.

Then 8 times 9 is 72 A. Then 6 times 9 is 54 A.  
 And 8 times 15 is 120 B. And 6 times 15 is 90 B.  
 And 8 times 21 is 168 C. And 6 times 21 is 126 C.

Proof=260

Proof=270

## QUEST. VI.

Two Merchants company, A puts in 36 Pound, and taketh  $\frac{2}{3}$  of the Gain, what did B put in?

If A take up  $\frac{2}{3}$ , B must needs have  $\frac{1}{3}$ .

Then say, If  $\frac{2}{3} : 36 :: \frac{1}{3} : Facit\ 24\ for\ B.$

$$\begin{array}{r} 3) 72 \text{ (24)} \\ \underline{6} \end{array}$$

12

12

0

Seeing the Denominators of the Fractions are equal, I neglect them, and work with the Numerators.

## QUEST. VII.

Two Merchants company, A put in 20 l. and B put in 144 Ducats; they gained 67 l. 10 s. of which A took up 30 l. What is the Value of a Ducat? Answer 6 s. 3 d.

First find a Stock for B; equivalent to A's Stock; thus:

$$\text{If } 30 : 20 :: 67.5$$

$$144 : 45000 \cdot 3125 = 20$$

to 6 s. 3 d.

$$432 \quad 130) 1350.0 \quad (45 l. = to 144 Duc.$$

$$180$$

$$144$$

$$360$$

$$288$$

$$720$$

$$720$$

$$0$$

$$120$$

$$150$$

$$150$$

$$00$$

QUEST.



QUEST. VIII.

Two Merchants put in Money together, and gained 120 l. Their Agreement was, that A should have 10 l. per Cent. Gain, and B 8 l. per Cent. What must each have?

Suppose each Man's Gain per Cent. to be his Stock; so A's Stock will be 10 l. and B's Stock 8 l. whose Sum is 18 l. Then say, as 18 l. : 120 l. :: 10 l. Facit 66 2/3, for A's Gain, then B must have 53 1/3.

$$18 : 120 :: 10$$

10

$$18 : 120 (66 \frac{2}{3}) = A's \text{ Part.}$$

$$108$$

$$120 : 120$$

$$108 : 66 \frac{2}{3}$$

$$12 : 53 \frac{1}{3} B's \text{ Part.}$$

QUEST. IX.

A, B, C and D put in Money together, and gained a Sum of Money, of which A, B and C took 60 l. B, C and D took 90 l. C, D and A took 80 l. and D, A and B took up 70 l. What distinct Gain did each take up?

Add these 4 Numbers into one Sum, which makes 300 l. in which each Man's Money is named 3 times; therefore take 1/3 of it makes 100 l. for the whole Gain; from which subtract A, B and C's Gain 60 l. leave D's Gain 40 l. and from the same Sum 100 l. subtract what B, C and D took up, leaves 10 l. for A; and from the same Sum 100 l. subtract what C, D and A took up, to wit 80 l. leaves 20 l. for B's Gain. And lastly, If from 100 l. you subtract what D, A and B took up, 70 l. leaves 30 l. for C's Gain. So A had 10 l. B 20 l. C 30 l. and D 40 l.

## QUEST. X.

Four Men bought a Hive of Bees for 20 Shillings, of which  $A$  must pay  $\frac{1}{2}$ ,  $B$   $\frac{1}{3}$ ,  $C$   $\frac{1}{4}$ ,  $D$   $\frac{1}{6}$ : what must each pay of the 20 Shillings?

Here if you take the natural Parts of 20 Shillings as they are expressed in the Question,

of 20 = 6 : 8 But the Sum to be paid is 20 s.  
 Then  $\left\{ \begin{array}{l} \frac{1}{2} \text{ of } 20 = 10 : 0 \\ \frac{1}{3} \text{ of } 20 = 6 : 8 \\ \frac{1}{4} \text{ of } 20 = 5 : 0 \\ \frac{1}{6} \text{ of } 20 = 3 : 4 \end{array} \right.$  wherefore 20 must be divided into such Proportion as the Parts bear one to another.

Sum = 19 : 0

Wherefore reduce the Fractions  $\frac{1}{2}$ ,  $\frac{1}{3}$ ,  $\frac{1}{4}$ ,  $\frac{1}{6}$ , into a common Denominator, which will be  $\frac{6}{6}$ ,  $\frac{4}{6}$ ,  $\frac{3}{6}$ ,  $\frac{2}{6}$ , and neglecting the Denominators, add the Numerators into one Sum, which will be 57; then the Proportion is

As 57 : To 20 :: So  $\left\{ \begin{array}{l} 20 : \text{To } 7\frac{1}{3} \text{ for } A's \\ 19 : \text{To } 6\frac{2}{3} \text{ for } B's \\ 12 : \text{To } 4\frac{1}{3} \text{ for } C's \\ 10 : \text{To } 3\frac{1}{3} \text{ for } D's \end{array} \right.$  Payment.

Proof 20 : 0

But if the Agreement had been, that  $A$  must pay  $\frac{1}{2}$ ,  $B$   $\frac{1}{3}$ ,  $C$   $\frac{1}{4}$ ,  $D$   $\frac{1}{6}$ , then the Parts would have exceeded the Whole.

For  $\frac{1}{2}$  of 20 is 10 : 0 In this Case work as before, by  
 $\frac{1}{3}$  of 20 is 6 : 8 reducing the Fractions into com-  
 And  $\frac{1}{4}$  of 20 is 5 : 0 mon Denominators, which will  
 And  $\frac{1}{6}$  of 20 is 3 : 4 be  $\frac{10}{12}$ ,  $\frac{8}{12}$ ,  $\frac{3}{12}$ ,  $\frac{2}{12}$ , the Sum of the  
 Numerators is 23 : 0 Then,

Sum is 23 : 0  
 As 23 : To 20 :: So  $\left\{ \begin{array}{l} 20 : \text{To } 8\frac{4}{11} \text{ for } A's \\ 15 : \text{To } 6\frac{4}{11} \text{ for } B's \\ 10 : \text{To } 4\frac{4}{11} \text{ for } C's \\ 8 : \text{To } 3\frac{4}{11} \text{ for } D's \end{array} \right.$  Payment.

Proof 20 : 0

The Merchant's Stock 1000  
The Factor's Stock 200

1000

FACTORSHIP

UNDER this Head may be reckoned those Questions which belong to Factorship, such as are these following.

QUEST. I.

A Merchant delivers unto his Factor 50 l. and if the Factor put in 30 l. he will allow him half of the Gain; What is the Factor's Person esteemed at?

Subtract 30 l. from 50 l. resteth 20 l. and so much is the Factor's Person esteemed at. The Reason is evident.

QUEST. II.

A Merchant delivers unto his Factor 60 l. and allows him for his Gains  $\frac{1}{2}$  of the Gain: What Money must the Factor put in, that he may have equal Gain?

From 60 l. take  $\frac{1}{2}$ , which is 30 l. which subtract from 60 l. leaves 30 l. which the Factor must put in to have half the Gains.

QUEST. III.

A Merchant delivers to his Factor 500 l. and esteems his Person at 200 l. When they made up their Accounts, they gained 20 l. per Cent. What is the Factor's Part?

To 500 add 200, the Sum is 700: Then say, if 100 l. gain 20 l. what 700 l.? Facit 140 l. Then if 700 l. gain 140 l. what 200 l.? Facit 40 l. the Factor's Part, and the Merchant must have 100 l.

QUEST. IV.

A Factor receives 1000 l. from a Merchant, to which he adds 300 l. of his own; his Person is esteemed at 260 l. What must the Factor have of the Gain?

It is evident, the Merchant's Stock is 1000 l. and the Factor's own Stock 300 l. together with 260 l. his personal Value, makes 1560 l. to which the Factor's Stock is equivalent.



|                      |      |
|----------------------|------|
| The Merchant's Stock | 1000 |
| The Factor's Stock   | 560  |

Sum 1560

Then say, If 1560 : 1 :: 560, Facit  $\frac{11}{13}$ , for the Factor's Share; then the Merchant must have  $\frac{4}{13}$  for his Share.

## DOUBLE FELLOWSHIP.

IT is called *Double Fellowship*, when their Gains are different, not only in respect to their Stocks, but in respect of the Time of Continuance in Company. And that you may work any such Question, observe this general Rule.

As the total Sum of the Products of each Man's Money and Time : Is to the total Gain : So the particular Product of each Man's Money and Time : Is to each Man's particular Gain.

## QUEST.

A and B put in Money together; A put in 20 l. and B put in 20 l. likewise: But A's Money was in Company 9 Months, and B's but 6 Months; they gained 60 Rounds? What must each have?

A's Money multiplied by his Time, is 180  
B's Money multiplied by his Time, is 120

The Sum 300

Then, as 300 : 60 :: 180 : 36 A's Gain.

120 : 24 B's Gain.

## QUEST.

A, B and C put in Money together; A put in 20 l. for 6 Months; B put in 40 l. for 3 Months; and C's Money was 60 l. which continued in Company 2 Months; their common Gain was 36 l. What must each have of the Gain?

First,

*Double Fellowship.* A

2811

**First, Multiply A's Money By his Time**

The Product of A's Money and Time = 120  
 Multiply B's Money 40 Pounds.  
 By his Time 3 Months.

The Product of *B*'s Money and Time = 120  
 Multiply *C*'s Money 60 Pounds.  
 By his Time 2 Months.

The Product of C's Money and time = 120

Now seeing the three Products are equal one with another, it is evident every Man must have an equal Share of the Grain : So each Man's Part is 12  $\frac{1}{2}$ .

QUEST. III.

**A, B and C put in Money together; A put in 20 l. for 3 Months, B put in 30 l. for 5 Months, and C put in 40 l. for 7 Months; they gained 60 l. What must each have of the Gain?**

Multiply every Man's Money by his Time, and the three Products will be found to be, for  $A$  60, for  $B$  150, and for  $C$  280, whose Sum is 490.

Then say, if  $490 : 60 :: 150$  Facit  $\left\{ \begin{array}{l} 18 \frac{11}{40} \\ 34 \frac{11}{40} \end{array} \right\}$

**Proof 60.00**

QUEST. IV.

*A and B company: A put in the first of January 50l. but B could not put any Money in till the first of May; What must B then put in, to have an equal Share with A at the Year's End?*

If I multiply 50 *l.* which is *A's* Money, by 12 Months, which is *A's* Time, it will produce 600 *l.* Now it is plain, that *B's* Money can but be in Company 8 Months; it is likewise evident that so much Money is required of *B*, which





# *Double Fellowship.*

283

l. l. l.  
If 200 : 60 :: 256  
60

200) 15360 (76.8

1400

1360

1200

1600

1600

0

Then say, If 10 Months come from 76.8; what will 8 Months come from? *Facit* 96. For seeing the Time is less, it must come from a greater Stock.

M. l. M.

If 10 : 76.8 :: 8

10

8) 768.0 (96 = the Value of the whole Cloth.

72

48

48

0

Divide 96 l. by 160, gives the Value of a Yard, viz. 12 Shillings.

160) 96.0 (.6 = to 12 s.

960

0

After the same Method must you find the Value of a Ducat; for first I say, If 200 l. which is A's Gain, come from 60 l. which is A's Stock, what will 175 l. come from, which is C's Gain? *Answ.* from 52½, or 52.5.

0 0

18

## Double Fellowship.

l. l. l.  
If 200 : 60 :: 175  
60

200) 10500 (52.5

1000

500

400

1000

1000

0

Secondly, If 10 Months produce 52.5; what will 7 Months? Answer 75 l. for seeing the Time is less, the Money will be more.

M. l. M.  
If 10 : 52.5 :: 7  
10

7) 525.0 (75 l. = to 240 Ducats.

49

35

35

0

Which if divided by 240, gives in the Quotient .3125 which is equal to 6 s. and 3 d. the just Price of a Ducat.

## QUEST. VI.

A, B, and C company, and put in together 3822 l. A's Money was in 3 Months; B's Money was in 5 Months, and C's Money was in 7 Months: They gained 234 l. which was so divided, as the  $\frac{1}{2}$  of A's Gain was equal to  $\frac{1}{3}$  of B's Gain, and  $\frac{1}{4}$  of B's Gain was equal to  $\frac{1}{4}$  of C's Gain: What did each Merchant gain and put in?

Suppose

## Double Fellowship.

285

Suppose *A*'s Gain was 4*l*. then must *B* have 6*l*. and *C* 8, according to the Tenor of the Question; which Numbers added together make 18: Then I say,

$$\text{If } 18 : 234 :: \left\{ \begin{array}{l} 4 \\ 6 \\ 8 \end{array} \right\} \text{ Facit } \left\{ \begin{array}{l} 52 \text{ } A\text{'s Gain.} \\ 78 \text{ } B\text{'s Gain.} \\ 104 \text{ } C\text{'s Gain.} \end{array} \right.$$

Next, multiply every Man's Gain by his Time, and the Sum of the three Products will be 1274; by which dividing the whole Stock, you will compute a common Multiplier, by which every Man's Gain and Time multiplied, gives each Man's Stock sought.

See the Work.

$$\begin{array}{r} 1274 \overline{) 3822} \quad (3 \text{ Com. Mul.} \\ \underline{3822} \\ 0 \end{array}$$

$$A\text{'s Gain and Time} = 156$$

3

$$468 \text{ } A\text{'s Stock.}$$

$$B\text{'s Gain and Time} = 390$$

3

$$1170 \text{ } B\text{'s Stock.}$$

$$\text{Then } C\text{'s Stock must be } 2184$$

## Q U E S T . VII.

*A*, *B*, and *C* company; *A* put in the first of *January* 100*l*. and the first of *May* puts in 150*l*. more; and on the first of *September* takes out 30*l*. The Remainder stays in till the Year's End.

*B* put in the first of *January* 250*l*. and on the first of *June* 60*l*. more; and on the first of *November* 100*l*. more; which continues in till the Year's End.

*C* put in the first of *January* 300*l*. and the first of *April* takes out 200*l*. and on the first of *August* takes out 50*l*. more; the Remainder stays in till the Year's End: What must each have of the Gain, which was 133 Pounds?

O o 2

It



It is plain that *A* hath 100*l.* in for 4 Months, and 250*l.* for 4 Months, and 220*l.* for 4 Months, which 3 Products will be 2280 for *A*'s whole Money and Time; and it is evident that *B* hath 250*l.* in for 5 Months; and 310*l.* for other 5 Months, and 410*l.* for 2 Months, which 3 Products will be 3620 for *B*'s whole Money and Time. It is likewise evident that *C* hath 300*l.* in for 3 Months, and 100*l.* for 4 Months, and 50*l.* in for 5 Months; so the 3 Products will be 1350 for *C*'s whole Money and Time: And by the Work of the second Question the Parts of the Gain will be found,

For  $\left\{ \begin{array}{l} A's \text{ Part } 40.71 \\ B's \quad \quad 64.62 \\ C's \quad \quad 27.67 \end{array} \right\} \text{ The Sum } 133.$

## LOSS and GAIN.

**B**Y this Rule we discover what is got or lost *per Cent.* in selling and buying Goods; and instructs us how to raise or fall the Price of Goods, to gain or lose so much *per Cent.* or otherwise, either with or without Time.

This is of excellent Use to most Traders; and there being a great deal of Variety in it, we will endeavour to make all plain in the following Questions or Examples.

### QUESTION I.

If I buy Yarn for 9*d.* the Pound, and sell it again for 13*d.*  $\frac{1}{2}$ , what is gained *per Cent.* or in laying out 100*l.* at that Price?

Say, If 9*d.* become 13*d.*  $\frac{1}{2}$ , what will 100*l.* become?  
*Fact* 150, and 150—100, gives 50*l.* for the Gain.

$$\begin{array}{l} d. \quad d. \\ 9 : 13.5 :: 100 \end{array}$$

$$\begin{array}{r} 9) 1350.0 \quad (150 \\ \underline{9} \quad \quad \quad 100 \end{array}$$

9

50 the Answer.

45

45

00

QUEST.

QUEST. II.

If I buy Broad Cloth for 11 s. 6 d. the Yard, how must I sell it to gain 20 l. per Cent?

Say, If 100 become 120, what will 11 s. 6 d. or 11.5 become? *Facit* 13.8 or 13 s. and 9 d.  $\frac{1}{2}$ ; and so much much I sell it for to gain 20 l. per Cent.

Here having cut off one Figure for the Decimal, I cut off 2 more instead of dividing by 100,

$$100 : 120 :: 11.5$$

$$115$$

$$600$$

$$120$$

$$120$$

$$13.800$$

$$13.800 \text{ Ans. } 13.8.$$

QUEST. III.

If I buy C. Weight of Tobacco for 4 l. 13 s. 4 d. and sell it again for 11 d. the Pound, whether do I gain or lose, and what per Cent?

First find by Practice what the C. will cost at 11 d. the Pound, which by the Work is found to be 5 l. 2 s. 8 d. Then say,

$$\text{If } 4.666 : 5.133 :: 100 : 110 \text{ Facit } 2.8$$

And 110 l. minus 100 l. is 10 l. the Gain sought.

$$0.933$$

$$1.133$$

$$5.133 = 5 : 2 : 8$$

QUEST. IV.

If a Pack of Yarn, weighing, 240 lb. cost 14 l. what must a Pound be sold for to gain 15 l. 10 s. per Cent?

Find what a Pound will cost, which in this Case is easy; for a Pack weighing 240 lb. as many Pounds as the Pack costeth, so many Pence the Pound will cost: So here a Pound will by that Rule cost 13 d. Then say,

If

## Loss and Gain.

l. l. d. d.  
If 100 : 115.5 :: 13 U Facit 15.015

13

3465

1155

15.015 The Answer.

## QUEST. V.

A *Manchester* Man buyeth Yarn for 6 s. the Bundle; which not proving so good as expected, would put it off again, so as but to lose 6 per Cent. by it. The Question is, what will a Bundle cost?

s. l. s.

Say, If 100 : 94 :: 6 Ans. 5 s. 7 d. 2 q.  $\frac{1}{2}$ .

3.8.1.0.0.8.8.1.6

Facit 5.14 = to 5 s. 7 d.  $\frac{1}{2}$  and half a Farthing; and so much he must sell it for.

## QUEST. VI.

If I buy Inle for 8 s. the Gross, how many Yards may I sell for a Penny to gain 20 per Cent?

First, I say, if 100 : 120 :: what 8 : Facit 9.6; then

turn a Gross into Yards thus, multiply 24, the Pieces in a Gross, by 36, the Yards in a Piece, Facit 864 Yards.

Then say, If  $\frac{1}{12}$  of a Shilling buy  $\frac{1}{12}$  of a Yard, what will  $\frac{1}{12}$  of a Shilling buy? Facit  $\frac{864}{12} = 72$ , or 7 Yards and a half; and so many he may sell for a Penny, and gain 20 l. per Cent.

See the Work.

$\frac{96}{10} : \frac{864}{10} :: \frac{1}{12} : \frac{1}{12}$   
 $\frac{96}{10} : \frac{864}{10} :: \frac{1}{12} : \frac{1}{12}$  or 7 Yards  $\frac{1}{2}$ .

## QUEST. VII.

If I sell Inle for 12 s. a Gross, wherein is lost after 5 per Cent. What did a Yard cost?

Say,



# Loss and Gain.

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Say, if 95 l. come from 100 l. what doth 12 l. come from? *Facit*  $12\frac{1}{5}$ .

$$95 : 100 :: 12$$

$$95) 1200 (12\frac{60}{100}, \text{ or } \frac{12}{5}$$

$$\underline{95}$$

$$250$$

$$\underline{190}$$

$$60$$

## QUEST. VIII.

A *Manchester* Chapman going to a Fair, sold Fustians for 11 s. 6 d. the End, wherein was gained 15 l. per Cent. and seeing no other Chapman had so good, raiseth them at the latter End of the Fair to 12 s. I demand what he gain'd per Cent. by this last Sale?

Say, If 11 s. 6 d. gain 15 l. what will 12 s. gain? Multiply and divide, and the Answer will be found to be 15 l. 13 s. 00 d. 2 q.

*See the Work.*

$$\text{If } 11.5 : 15 :: 12$$

$$\underline{12}$$

$$30$$

$$\underline{15}$$

$$11.5) 180.000 (15.652 \text{ gain'd by the last Sale.}$$

$$\underline{115}$$

$$650$$

$$\underline{575}$$

$$750$$

$$\underline{690}$$

$$600$$

$$\underline{575}$$

$$250$$

$$\underline{230}$$

$$20$$

## QUEST.

## QUEST. IX.

A *Manchester* Man buys 20 Tun of Cheese, with which he went into *Ireland*; it cost him 400 *l.* the Freight and Custom came to 50 *l.* his own Expences and Charges came to 16 *l.* 13 *s.* 4 *d.* how must he sell it *per* Pound to gain 20 *per Cent.* by it?

Collect the Cost and Charges into one Sum, and say, If 100 *l.* become 120 *l.* what will 466 *l.* 13 *s.* 4 *d.*

Cost, First Penny ——— 400 : 00 : 0

Freight and Custom 50 : 00 : 0

His own Charges — 16 : 13 : 4

Sum 466 : 13 : 4

See the Work.

*l.*      *l.*      *l.*      *l.*

If 100 : 120 :: 466.666 : Facit 560

Say again, If 44800 Pound of Cheese (and so many is in 20 Tun) cost 560 Pound, what will one Pound cost?  
*Answ.* 3 *d.* As by the Work appeareth.

*lb.*      *l.*      *l.*

If 44800 : 560 :: 1

I

44800) 560.0000 (.0125 = to 3 *d.*

44800

112000

89600

224000

224000

0

QUEST.

Q U E S T. X.

A Merchant selling Corn at 8 s. the Bushel, gain'd 10 l. per Cent. but afterwards being by a falling Market forced to sell it for 7 s. What did he gain or lose per Cent. by this last Sale?

Say, if 8 s. make 110 l. what 7 s. ? Facit 96  $\frac{1}{2}$ , whereby he lost 3 l. 15 s. per Cent. by this Sale.

If 8 : 110 :: 7

$$\begin{array}{r} 7 \\ \hline 8) 770 \quad (96\frac{1}{2} \quad 96\frac{1}{2} \\ \underline{56} \phantom{00} \\ 210 \phantom{00} \\ \underline{168} \phantom{00} \\ 420 \phantom{00} \\ \underline{336} \phantom{00} \\ 840 \phantom{00} \\ \underline{770} \phantom{00} \\ 70 \phantom{00} \\ \underline{70} \phantom{00} \\ 0 \phantom{00} \end{array}$$

Q U E S T. XI.

If I buy Yarn for 9 d. and sell it for 12 d. and allow 3 Months for Payment, what do I gain per Cent. per Ann. ?

This Question admits of a double Meaning, and by that means of a double Answer.

For first, it is evident if he on this Sale had received ready Money, he would have gained 33 l.  $\frac{1}{3}$  per Cent. but giving 3 Months for Payment, his Gain must needs be less, by as much as the Rebate of 133 l.  $\frac{1}{3}$  for 3 Months amounts to. Which, by Proposition the Second of Simple Interest, will be found to be 1 l. 19 s. 5 d. which subtract from 33 l. 6 s. 8 d. leaves 31 l. 7 s. 3 d. the Gain in this Case sought.

So he makes his 100 l. to be 131 l. 7 s. 3 d.

But some Authors would answer this Question thus : First, they say,

If 9 : 12 :: 100 : Facit 133  $\frac{1}{3}$  as before.

P p

But



But instead of making the Gain less, by giving Time, they make it vastly more; thus; for they say,

If 3 Months gain 33  $l.$  4, what will 12 Months gain?

*Ans* 133  $l.$  6  $s.$  8  $d.$  The Gain sought.

So they make his 100  $l.$  to be 133  $l.$  6  $s.$  8  $d.$

But you may use that which agrees best with your own Reason.

*Note*, We allow 6 *per Cent.* Simple Interest for the Rebate in the Question foregoing, that being the Rate allowed by the Statute.

### *The Rule of ALLIGATION.*

**A**LLIGATION teacheth how to mix or unite many Simples, or Particulars, into one Mass or Sum, according to any Price or Proportion required.

For the Ease of the Learner, we shall divide this Rule into 4 Varieties, that so when a Question is propounded, it is but considering what Variety it falls under, and the Work will soon be finished.

#### VARIETY I.

In this Variety we have given the Prices and Quantities of several Simples to be mixed, and the mean Rate or Price of any Part of such Mixture is required.

To find which, the Proportion is,

As the Sum of the Simples to be mixed :

To the total Value thereof ::

So is any Part of the Composition :

To the Value thereof.

#### EXAMPLE.

A Tobacconist would mix 20  $lb.$  of Tobacco at 9  $d.$  the Pound, with 60  $lb.$  at 12  $d.$  the Pound, and with 40  $lb.$  at 18  $d.$  the Pound, and with 12  $lb.$  at 2  $s.$  the Pound. The Question is, what a Pound of this Mixture is worth?

Place

# The Rule of Alligation.

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Place the Numbers and their Values as underneath.

| lb. | s. | d. | per lb. | will cost | o         | 15 | o  |
|-----|----|----|---------|-----------|-----------|----|----|
| 20  | at | 0  | 9       | per lb.   | will cost | 3  | 00 |
| 60  | at | 1  | 0       | per lb.   | will cost | 3  | 00 |
| 40  | at | 1  | 6       | per lb.   | will cost | 1  | 04 |
| 12  | at | 2  | 0       | per lb.   | will cost |    |    |

Sum Simple = 132 Total Value = 7 19 0

Then say, If 132 Pound cost 7l. 19 s. what will 1 ?  
*Pacit* 1 s. 2 d. 2 q.

See the Work.

| lb. | l. | s. | d. |
|-----|----|----|----|
| 132 | :  | 7  | 95 |
| 1   | :  | 1  |    |

132) 7.95 (.06022 = to 1 s. 2 d. 1/2.  
 792

300

264

36

## QUEST. II.

A Farmer would mix 5 Bushels of Wheat at 6 s. the Bushel, with 12 Bushels of Rye, at 4 s. the Bushel, with 8 Bushels of Beans, at 5 s. the Bushel, and with 18 Bushels of Barley, at 2 s. 6 d. the Bushel. The Price of one Bushel of this Mixture was demanded.

Place your Numbers and their Values as under.

| B. | s. | d. | the Bush. | will cost | l.        | s. | d. |
|----|----|----|-----------|-----------|-----------|----|----|
| 5  | at | 6  | 0         | the Bush. | will cost | 1  | 10 |
| 12 | at | 4  | 0         | the Bush. | will cost | 2  | 8  |
| 8  | at | 5  | 0         | the Bush. | will cost | 2  | 0  |
| 18 | at | 2  | 6         | the Bush. | will cost | 2  | 5  |

Numb. Bush. 43 Total Value = 8 3 0

P p 2

Then

*The Rule of Alligation.*

Then say, If 43 Bushels cost 8*l*. 3*s*. or 8*l*. 5*s*. what will one Bushel? *Facit* 3*s*. 9*d*.  $\frac{1}{2}$ .

See the Work.  
 43 8.15 :: 1 04  
 43 8.15 :: 1 04

43) 8.15 (.1895 = 10 3*s*. 9*d*.  $\frac{1}{2}$  per 2.

43

385

344

410

387

230

215

15

*VARIETY II.*

In this Variety the Price of the Simples is expressed, but no Quantity given; and it is required how much of each Simple we must take to sell one Quantity or Measure at a mean Rate propounded.

The whole Work of this Variety is in linking the Extremes truly together, and taking the true Differences betwixt them and the Mean; and these Differences are the true Quantities sought.

*EXAMPLE*

A Merchant hath Spices, some at 9*d*. the Pound, some at 12*d*. some at 24*d*. and some at 30*d*. how much of each Sort must he take, that he may sell a Pound for 20*d*.?

First, Set down the several Prices of the Spices orderly under one another, with a Line of Connection to the Left-hand, as in the Example may be seen.

Note, That 9, 12, 24, 30, I call the Extremes; 9 and 12 being the two lesser Extremes, and 24 and 30 the two greater



greater: Then on the other hand let down the mean Price, as you see.

That done, I link or join together two Extremes, no matter which, so as one be bigger than the Mean, and the other less; and after that other two, till I have finished. So in this Example, I link 9 and 30 together, and 12 and 24, as you see; then take the Difference betwixt each Extreme and the mean Price, and place it over-against its Yoke-fellow: So the Difference betwixt 9 and 20 is 11, which place against 30 its Yoke-fellow; the Difference betwixt 12 and 20 is 8, which place against 24 its Yoke-fellow; betwixt 24 and 20 is 4, which place against 12 its Yoke-fellow; and lastly, the Difference betwixt 30 and 20 is 10, which place over-against 9 its Yoke-fellow, as you see here done. And the Differences here found will be the Answer to the Question; for as oft as he takes 10 lb. of 9 d. a Pound, he must take 4 of 12 d. a Pound, and 8 at 24 d. the Pound; that so a Pound may be afforded for 20 d. or 1 s. 8 d.

|    |    |    |
|----|----|----|
|    | 9  | 10 |
|    | 12 | 4  |
| 20 | 24 | 8  |
|    | 30 | 11 |

The Proof thereof is easy by the last Variety; for the Sum of the Difference found, multiplied by 20, is equal to the Sum of the Products of the Difference and Extremes. But if at any time, as here it happens, that the Extremes may be linked more ways than one, then the Question admits of more Answers than one, yet all true; for if in this Question, we link 9 and 24, and 12 and 30, and place the Differences respectively, then we shall have 4 at 9 d. a Pound, 10 at 12 d. a Pound, 11 at 24 d. a Pound, and 8 at 30 d. a Pound; and that this is likewise true, may be proved, as in the last, and the mean Price will be found to be 20 d.

|    |    |    |
|----|----|----|
|    | 9  | 4  |
|    | 12 | 10 |
| 20 | 24 | 11 |
|    | 30 | 8  |

Again, if we link 9 and 30 together, 12 and 20, and 12 and 24, there will arise a new Method in placing the Differences; for if any Extreme have two Yoke-fellows, it will

|    |    |    |    |
|----|----|----|----|
|    | 9  | 10 | 10 |
|    | 12 | 4  | 10 |
| 20 | 24 | 8  | 8  |
|    | 30 | 11 | 8  |

likewise have two Differences: So the Differences betwixt

9 and 20 is 11, which place over against 30, its Yoke-fellow; the Difference betwixt 12 and 20 is 8, which because it has two Yoke-fellows, place against them both, to wit, against 24 and 30, as you see; the Difference betwixt 24 and 30 is 4, which place against 12 its Yoke-fellow; and lastly the Difference betwixt 30 and 20 is 10, which place against both its Yoke-fellows, to wit, 12 and 9. Then draw a straight Line, and beyond it the Differences; so first I set down 10, then 10 and 4 is 14, which set down; then set down 8, then 11 and 8 is 19, which likewise place down; then as oft as he takes 10 at 9 *d.* the Pound, he must take 14 at 12 *d.* the Pound, and 8 at 24 *d.* the Pound, and 19 at 30 *d.* the Pound, that so a Pound may be worth 20 *d.*

And lastly, if we link 9 both with 24 and 30, and 12 both with 24 and 30, and 24 both with 12 and 9, and 30 both with 12 and 9, then the

|    |   |       |  |       |  |                                 |  |                                |
|----|---|-------|--|-------|--|---------------------------------|--|--------------------------------|
| 8  | { | 9     |  | 4. 10 |  | 14                              |  | Difference betwixt 9 and 20,   |
| 12 |   | 4. 10 |  | 14    |  | which is 11, is to be placed a- |  |                                |
| 20 |   | 11. 8 |  | 19    |  | gainst 24 and 30; and also the  |  |                                |
| 24 |   | 11. 8 |  | 19    |  | Difference betwixt 12 and 20,   |  |                                |
| 30 | { | 11. 8 |  | 19    |  |                                 |  | which is 8, against 24 and 30, |
|    |   |       |  |       |  |                                 |  | for the same Reason; and the   |

Difference betwixt 24 and 20, which is 4, against 12 and 9, they being thereunto linked; and lastly the Difference betwixt 20 and 30, which is 10, place against 12 and 9, for the same Reason; then on the other Side the Line, place the Sum of the Differences against their respective Numbers, as you see in the Example: So by this *Alligation*, you will find, he must take 14 *lb.* at 9 *d.* and 12 *d.* the Pound, and 19 *lb.* at 24 *d.* and 30 *d.* to make a Pound worth 20 *d.*

I shall not name any more ways of linking these Numbers, these being sufficient to understand how to link them any way, and leave the rest to the Scrutiny of the Learner, to exercise himself with: For I have been the larger in these Examples, that I may not trouble myself any more with the Method of linking in the Examples following; only Note, that if at any time you have but one Extreme, either lesser or bigger than the Mean, It will but admit of one way of linking, and the Question will have but one Answer, as in the following Example may be seen.

EXAMPLE.

A Merchant hath Wines; Canary at 24 *d.* the Quart, Sherry at 16 *d.* the Quart, and Malaga at 12 *d.* the Quart, how much of each Sort must he take to sell a Quart for 18 *d.*? This Question you see admits but of one way of linking, and so but one Answer; and observing the Directions before given, you will find 8 of Canary, 6 of Sherry, and 6 of Malaga must be mixed together, that so a Quart may be sold for 18 *d.*

$$\begin{array}{r|l} 24 & 8 \\ 16 & 6 \\ 12 & 6 \end{array} \quad \begin{array}{l} 268 \\ 6 \\ 6 \end{array}$$

It must however be observed, that tho' the *Rule of Alligation* will give but one Answer, yet all Numbers that are in the same Proportion between themselves, as the Numbers which compose the Answer, will likewise satisfy the Condition of the Question. Thus 4 Quarts of Canary, 3 of Sherry, and 3 of Malaga, will compose a Mixture worth 18 *d.* per Quart. For as 8 : 6 :: 4 : 3. In like manner 24 Quarts of Canary, 18 of Sherry, and 18 of Malaga, will also satisfy the Question. For as 8 : 6 :: 24 : 18. And after the same manner an infinite Number of Answers may be found.

Nor is this all; for by the Help of a particular Method, which we shall now explain, an innumerable Number of other Answers may be found, without the Numbers which compose them being in the same Proportion.

Let us, for instance, suppose that the Merchant is determined to use 6 Quarts of Malaga constantly in the Mixture; but to increase or diminish the Canary or Sherry, in any Proportion, that will produce a Mixture worth 18 *d.* per Quart.

Then may the Quantity of Canary be increased or diminished by 2, the Difference between the Price of the Sherry and the Price of the Mixture, provided the Quantity of Sherry be, at the same time, increased or diminished by 6, the Difference between the Price of the Canary and the Price of the Mixture. That is, the Canary may be increased to 10 Quarts, if, at the same time, the Sherry be increased to 12.

For



For 10 Quarts of Canary, at 24 *d.* are worth 240 *d.*  
 12 Quarts of Sherry, at 16 *d.* are worth 192 *d.*  
 6 Quarts of Malaga, at 12 *d.* are worth 72 *d.*

---

Therefore 28 Quarts of the Mixture are worth 504 *d.*  
 And 1 Quart is worth  $\frac{504}{28}$  or 18 *d.*

The same may be done by diminishing both the Quantities, instead of increasing them. And if, instead of the Numbers found, others in the same Proportion be taken, a prodigious Number of Answers may be found.

If the Sherry be supposed invariable, then the Quantity of Canary may be increased by 6; the Difference between the Prices of the Malaga and the Mixture, provided, at the same time, the Quantity of Malaga be increased by 6, the Difference between the Prices of the Mixture and Canary. That is, the Quantity of Canary may be increased to 14 Quarts, provided, at the same time, the Malaga be increased to 12.

For 14 Quarts of Canary, at 24 *d.* are worth 336 *d.*  
 6 Quarts of Sherry, at 16 *d.* are worth 96 *d.*  
 12 Quarts of Malaga, at 12 *d.* are worth 144 *d.*

---

Therefore 32 Quarts of the Mixture are worth 576 *d.*  
 And 1 Quart is worth  $\frac{576}{32}$  or 18 *d.*

If the Canary be supposed invariable, the Quantity of Sherry may be increased or diminished by 6, the Difference between the Prices of the Malaga and the Mixture, provided at the same time the Malaga be diminished or increased by 2 the Difference between the Prices of the Sherry and the Mixture. That is, the Quantity of Sherry may be increased to 12 Quarts, provided, at the same time, the Malaga be diminished to 4.

For 8 Quarts of Canary, at 24 *d.* are worth 192 *d.*  
 12 Quarts of Sherry, at 16 *d.* are worth 192 *d.*  
 4 Quarts of Malaga, at 12 *d.* are worth 48 *d.*

---

Therefore 24 Quarts of the Mixture are worth 422 *d.*  
 And 1 Quart is worth  $\frac{422}{24}$ , or 18 *d.*

By

By the same Method; all Questions of this Nature may be solved, and an infinite Number of Solutions found to each, out of which may be selected those that are most proper for the purpose, which is an Advantage that cannot be had from the common Rules of Alligation.

VARIETY III.

In this Variety we have the Price of all the Simples, and the Quantity of one given to find the Quantity of all the rest, so as one Measure or Quantity may bear a mean Rate or Price propounded: which to do, observe the Proportion following:

As the Difference standing against the Quantity given:

To the rest of the Differences besides:

So the Quantity given:

To the Quantity sought: Each to its respective Difference.

EXAMPLE.

A Tobacconist hath 30 lb. of the best Tobacco at 2 s. or 24 d. per Pound, which he would mix with some at 12 d. some at 9 d. and some at 7 d. and he would know how much of each Sort of the said less Prices must be mixed with the 30 lb. of the best, that he may sell it for a Penny the Ounce or 16 d. the Pound.

|    |    |    |   |   |    |
|----|----|----|---|---|----|
|    | 24 | 12 | 9 | 7 | 16 |
| 16 | 8  | 8  | 8 | 8 | 8  |
|    | 8  | 8  | 8 | 8 | 8  |
|    | 8  | 8  | 8 | 8 | 8  |

Having by the last Variety set down the Numbers, linked them, and found the Differences, as in the Example; then say, As 20, the Difference against the Quantity given: To 8, the next Difference: : So 30: To 12, the Quantity required at 12 d. the Pound. And seeing the other Differences are equal, it will require 12 Pound of each; so that he must take of the less Prices at 12 lb. a-piece, to mix with the 30 lb. of the best, that so a Pound may be afforded for

for 16 Pence. The Proof of this, and the following, are by the first *Parity*.

### EXAMPLE III

A *Goldsmith* hath 20 Ounces of Gold at 20 Carracts fine, and would mix it with some at 22 Carracts fine, and some at 24 Carracts fine; how much of 22 and 24 Carracts fine, and how much Alloy must he mix with the 20 Ounces of 20 Carracts fine, so as an Ounce, and consequently the whole Mass may be 18 Carracts fine?

*Note.* That Alloy is a sort of coarse Silver, or Copper, or some base Metal, with which *Goldsmiths* mix Gold of Silver, to abate the Fineness thereof.

An Ounce of Gold is divided into 24 Parts, called Carracts, and an Ounce of Silver into 20 Parts, called Penny-Weights; therefore to distinguish Fineness of Metals, such Gold as will abide the Fire without Loss, is accounted 24 Carracts fine; if it lose 2 Carracts in trial, it will then be 22 Carracts fine, &c.

Silver is valued in Ounces, and a Pound of Silver which loseth nothing in trial, is called 12 Ounces fine; but if it lose 2 Penny weight, it is then said to be 11 Ounces, 18 Penny-weight-fine.

First set down the Values in order as usual, with the mean Value, and in the Place of the Alloy, because it is not accounted of any Value, place a Cypher; then take the Differences, which by the linking you may see, will all be the same, except only in the Place of the Alloy. Then say,

|                       |   |    |          |    |
|-----------------------|---|----|----------|----|
| If 18 : 18 :: 20 : 20 | { | 20 | 18       | 18 |
| If 18 : 18 :: 20 : 20 |   | 22 | 18       | 18 |
| If 18 : 12 :: 20 : 13 |   | 24 | 18       | 18 |
|                       |   | 0  | 2.4.6.12 | 12 |

Thus you see, That with the 20 Ounces of 20 Carracts fine, there must be mixed 20 of 22 Carracts fine, and 20 of 24 Carracts fine, and 13 Ounces and  $\frac{1}{2}$  of Alloy, that so an Ounce would bear 18 Carracts fine.

By



## The Rule of Alligation.

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By changing the two last Terms of the Proportion in the foregoing Rule, which is the same thing in effect, we may work any of these Questions by the contracted way in Fellowship; and if there be any Fractions, bring them up Decimally.

If the Terms be changed, the Proportion stands;

As the Difference against that Price whose Quantity is given

Is to the Quantity given ::

So any other Difference :

To its Quantity sought.

### EXAMPLE III.

A Chapman hath Yarn at several Rates, and would mix 40 Pound, at 24 *d.* the Pound, with some at 20 *d.* some at 14 *d.* some at 9 *d.* and some at 7 *d.* How much of each Sort must he mix with the 40 Pound, at 24 *d.* the Pound, that he may sell a Pound for 16 Pence?

Having placed your Numbers, and linked them, and taken the Differences as in the Margin :

Then the Proportion is, as 16 to 40, what 2? what 4? what 8? what 8? Instead of these Operations divide 40 by 16, the Quotient, multiplied by every Difference, gives every particular Quantity sought.

|    |     |    |
|----|-----|----|
| 24 | 7.9 | 16 |
| 20 | 2   | 2  |
| 14 | 4   | 4  |
| 9  | 8   | 8  |
| 7  | 8   | 8  |

*See the Work.*

First, Mult. 2.5

By 2

16) 40 (2.5

32

5.0 at 20 *d.* the Pound.

80

80

2dly, Mult. 2.5

By 4

10.0 at 14 *d.* the Pound.

3dly, Mult. 2.5

By 8

20.0 at 9 *d.* and 7 *d.* the Pound.

Q q 2

S.

So you see with the 40 at 24 *d.* the Pound, he must mix 5 at 20 *d.* the Pound, and 10 at 12 *d.* the Pound, and 20 at 9 *d.* and 7 *d.* the Pound; and so a Pound will be worth 16 Pence.

## VARIETY IV.

In this *Variety* the Prices of every Simple is expressed, and the mean Rate or Price; and it is required to find how much of each Sort must be taken, to make up a certain Quantity propounded, agreeable to the mean Rate given?

Which to do, observe the Proportion following:

As the total Sum of the Differences;

To the total Quantity given;

So any particular Difference;

To its particular Quantity sought.

## EXAMPLE.

A Grocer hath 4 Sorts of Currants, one at 4 Pence the Pound, another at 6 *d.* another at 9 *d.* and the best at 11 *d.* the Pound: The worst would not sell, and the best were too dear, and he concludes to mix 240 Pound, and so much of each Sort, as to sell a Pound for 8 Pence: How much of each Sort must he take?

Having placed your Numbers with the mean Price, linked them and taken the Difference, as here, divide 240 by 10; quotes 24, multiplied by every Difference, gives

72, for the Quantity of 4 *d.* the Pound; and 24 for the Quantity at 6 *d.* the Pound; and 48 for the Quantity at 9 *d.* the Pound; and 96 for the Quantity at 11 *d.* the Pound, the Sum making 240, is the Proof.

*Note,* If he hath a Desire to put off more of his worst Sort, he may alter the Quantities by some other way of linking, as was shewed in the second *Variety*.

QUEST.

Q U E S T. II.

A Goldsmith hath several Sorts of Gold, some of 24 Carraets fine, some of 22 Carraets, some of 18 Carraets, some of 16 Carraets fine, and is desirous to melt of all these Sorts, so much together, as may make a Mass of 60 Ounces of 21 Carraets fine. How much of each Sort must he take?

The Numbers being placed, linked and differenced, as hath been shewed, and is here expressed: I say,

$$\begin{array}{r}
 24 \text{ --- } 5 \\
 22 \text{ --- } 3 \\
 18 \text{ --- } 1 \\
 16 \text{ --- } 3 \\
 \hline
 12 \text{ Proof } 60
 \end{array}
 \begin{array}{r}
 25 \\
 15 \\
 5 \\
 15 \\
 \hline
 \end{array}$$

1 As 12 : 60 :: 5 : 25  
 2 As 12 : 60 :: 3 : 15  
 3 As 12 : 60 :: 1 : 5  
 4 As 12 : 60 :: 3 : 15

Or if you will use the contracted Way, divide 60 by 12, quotes 5; by which multiplying each Difference, gives the same Quantities. So I conclude that 25 Ounces of 24 Carraets fine, 15 Ounces of 22 Carraets fine, 5 Ounces of 18 Carraets fine, and 15 Ounces of 16 Carraets fine, will produce a Mass of Gold of 60 Ounces, and 21 Carraets fine.

Q U E S T. III.

How many Gallons of Water must be mixed with Wine, at 3 Shillings the Gallon, to fill a Vessel of 100 Gallons, so as a Gallon may be afforded for 2 s. 6 d.?

First, set down the Value of a Gallon of Wine, and the Water being of no Value, put a Cypher; then having set down the mean Rate, and linked, and taken the Difference; say, If 3 the Sum of the Difference, give 100, what will 2.5 Facit 83.333, or 83 and  $\frac{1}{3}$  of Wine? which subtracted from 100, leaves 16  $\frac{2}{3}$  for the Quantity of Water.

Q U E S T.



## QUEST. IV.

A Farmer hath two Vessels, one will hold 50 Gallons, and the other 30; and would know how much Water he must mix with Wine at 4 Shillings the Gallon, to fill the bigger Vessel, that every Gallon drawn may be worth 3 Shillings the Gallon; and with Wine at 2 Shillings and 6 Pence the Gallon, to fill the less Vessel that a Gallon may be worth 2 Shillings.

The Quantity of Water is demanded.

Prop. I.

$$\begin{array}{r} 3 \overline{) 43} \\ \underline{30} \\ 13 \end{array}$$

$$\text{If } 4 : 50 :: 3 : 37.5$$

Facit 37  $\frac{1}{2}$  Gallons of Wine; then there must be 12  $\frac{1}{2}$  of Water in the greater Vessel.

Prop. II.

$$\begin{array}{r} 2 \overline{) 25} \\ \underline{20} \\ 5 \end{array}$$

$$\text{If } 2.5 : 30 :: 2 : 24$$

Facit 24 Gallons of Wine; then there must be 6 of Water in the lesser Vessel.

## The Rule of FALSE.

THIS Rule is more for Recreation and Delight, than for any solid Use; but because it is an ingenious Rule, and may exercise the Wits of Youth, we shall here insert it.

The Rule of False is so named, not from the Falsity of it, but because we, by supposed Numbers, taken at adventure, and by them working the Question according to the Nature thereof, do, by those false supposed Numbers, find the true Numbers sought.

This Rule is divided into two Parts, commonly called the Single Rule and Double Rule.

**The Single Rule of FALSE.**

**I**N the *Single Rule* we need but use one Supposition, as may be seen in the Questions following.

**Q U E S T. I.**

A certain Sum of Money put out at 6 per Cent. Simple Interest, at the End of 10 Years amounts to 20 l. What was the Stock? *Answer* 12 l. 10 s.

Here I suppose any Number, as 10 Pound; then according to the Nature of the Question,

What will 10 l. amount to, forborn 10 Years? Which by the Table of *Simple Interest*, or by the *Double Rule of Three*, will be found to be 16 l. which should have been 20 l. if I had guessed right.

Now I say, If 16 l. come from 10 l. my supposed Number, what will 20 l. come from? *Answer* 12 l. 10 s. the Stock sought.

*See the Work.*

Suppose in 1 an Hour, or 60 : then must there empty at the greatest Cock 30 Gallons or 2, and by the second Cock 15 Gallons, or 1, and by the least Cock 10 Gallons, which added together make 55, which should have been 60. Now say, If 55 Gallons run in 30 Minutes, what will 60 Gallons run in? *Answer* 32.727, the Time sought.

**Q U E S T. II.**

A *Schoolmaster* being asked how many Scholars he had, answered, If I had as many,  $\frac{2}{3}$  as many, and  $\frac{1}{4}$ , or 1 quarter as many, I should have 99 : How many had he? *Answer* 36.

Suppose

Suppose he had any Number, as 40, then as many,  $\frac{1}{2}$  as many, and  $\frac{1}{4}$  as many, would make 110, which should have been 99. Then say,

If 110 come from 40, what will 99 come from? *Ans.* 36, the Number of Scholars sought.

*See the Work.*

If 110 : 40 :: 99 :

40

110) 3960 (36

330

660

660

### QUEST. III.

There is a Cistern with 3 unequal Cocks, containing 60 Gallons of Water; and if the greatest Cock be opened, the Cistern will be empty in one Hour; if the second Cock be opened, it will be empty in two Hours; if the third be opened, it will be empty in three Hours. Now I demand in what Time it will be empty, if all run together?

Suppose in  $\frac{1}{2}$  an Hour, or 30'; then must there empty at the greatest Cock 30 Gallons or  $\frac{1}{2}$ , and by the second Cock 15 Gallons, or  $\frac{1}{4}$ , and by the least Cock 10 Gallons, or  $\frac{1}{6}$ , which added together make 55, which should have been 60. Now say,

If 55 Gallons run in 30 Minutes, what will 60 Gallons run in? *Ans.* 32'.727, the Time sought.

### QUEST. IV.

Three Merchants, *A*, *B*, *C*, put in Money together, and gain'd 100*l*. of which *A* took up a certain Sum; *B* took up twice as much as *A*, or double to *A*; and *C* took up thrice as much as *B*, or treble to *B*: What did each take up apart?



## Double Rule of False.

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Suppose *A* took up 3 Pound, then *B* must have 6 Pound, and *C* 18 Pound, which makes 27 Pound, which should have been 100 Pound.

Then say, if 27 *l.* should be  $\left\{ \begin{array}{l} 3 \\ 6 \\ 18 \end{array} \right\}$  100 *l.* what  $\left\{ \begin{array}{l} 11.111111 = A \\ 22.222222 = B \\ 66.666666 = C \end{array} \right\}$  Fact

Proof 99.999999

See the Work.

27) 100 (3.703703 or 370 repeated

81

—

190

189

—

100

81

—

190

189

—

100

81

—

19

This Quotient multiplied by 3 for *A*, by 6 for *B*, and by 18 for *C*, produceth the former Numbers. See the contracted Way in *Fellowship*.

Thus may any Question of these Natures be wrought; so I shall forbear mentioning any more of *single Position*; only note, that if there be no Partition in Numbers to make a Proportion, you must use the *Double Rule*, which now we shall begin with.

## Double Rule of False.

In the *Double Rule* we use two Suppositions; and if with either we find the Numbers that satisfy the Question, there is no more to be done; but if, as commonly it happens, we err in both Suppositions, see whether they be greater or lesser than the Solution requires, which mark with +, *plus*, or — *minus*; and over-against either Supposition its respective Error, then observe this general Rule.

R r

As

As the Difference of Errors if alike, or Sum if unlike :

Is to the Difference of Suppositions ::

So is either Error to a fourth Number ; which, added to, or subtracted from, the Supposition over-against it, gives the Number sought. See the Examples.

### QUEST. I.

Good-morrow, good Fellow, with your 20 Geese. Nay, says he, I have not 20 ; but if I had as many,  $\frac{1}{2}$  as many, 2 Geese and  $\frac{1}{2}$ , then had I 20. I demand how many he had ?

First, Suppose 6, then as many,  $\frac{1}{2}$  as many, two Geese and  $\frac{1}{2}$ , would make 17 and  $\frac{1}{2}$ , which should be 20. The Error therefore is  $-2\frac{1}{2}$ , which mark 6—2.5 as in the Margin. 9+5

Secondly, Suppose he had 9, then as many,  $\frac{1}{2}$  as many, 2  $\frac{1}{2}$  would make 25, which should be 20. The Error therefore is + 5, which put down under the other, as you see done. Then, because the Errors are unlike, that is, one plus, the other minus, I say, as the Sum of the Errors 7.5 to the Difference of the Suppositions 3 :: So either Error, suppose the first 2.5 to 1 ; which, because the first Supposition was minus, according to the Rule added to 6, makes 7, the Number of Geese sought.

### QUEST. II.

A Gentleman had two Horses of good Value, and a Saddle worth 50 l. which set on the Back of the first Horse, makes his Value double the second ; but if set on the Back of the second Horse, makes his Worth treble the first Horse. The Price of each Horse is demanded ?

Suppose the Price of the first Horse be 20 Pound, which with the Saddle makes 70 l. Then seeing this is double the Price of the second Horse, the second will be worth 35 l. which with the Saddle would be 85, which should be 60, 3 times 20, the Price of the first Horse. The Error therefore is  $-25$ , which put down as you see.

Suppose against the first Horse worth 25 l. which with the Saddle would be 75 l. 20—25 then the second would be worth 37 l. 10 s. 25—12.5 or 37.5, which with the Saddle would amount to 87 l. 10 s. or

or 87.5 : which should be  $75 = 3$  times 25, the Price of the first Horse. The Error therefore is—12.5, which place under the other Error, and say,

As the Difference of Errors, because alike 12.5 :

To the Difference of Suppositions 5 ::

So either Error, suppose the first 25 : to 10, which added to the Supposition over-against it, because—, makes 30 the Price of the first Horse; and by consequence the Price of the second will be 40. And if you had taken the second Error 12.5, the fourth Number would have been 5, which added to 25, makes 30, as before.

P R O O F.

First Horse 30

Saddle = 50

Sum = 80

$\frac{1}{2} = 40$  = Second Horse,

Saddle = 50

Sum = 90

$\frac{1}{3} = 30$  = First Horse,

Q U E S T. III.

A stealing Apples, was taken by B, and, to appease him, gives him half he had, and B gives him back 10; and going farther met with C. and was forced to give him half of what he had left, and he returns him back 4; and going farther meets D, and gives him half he had, and he returns him back 1; and getting safe away, finds he had 13 left: What had he at first?

Suppose first 80, and working according to the Nature of the Question, he had  $15\frac{1}{2}$  left, which is + 2.5.

Supposing again he had 40, and working as before, he will have  $10\frac{1}{2}$  left, which is — 2.5.

Then working by the general Rule, you will find he had 60 Apples at the first.

$80 + 2.5$   
 $40 - 2.5$

But the Number sought in this Question may more quickly be found: For Note, That if at any time, as here it happens, that the Errors are the same in Quantity, and



## Double Rule of False.

unlike in Quality, half the Sum of the Suppositions is the Number sought; and the Sum of the Suppositions is 120, half of which is 60 as before.

See the Work both Ways.

|                  |         |
|------------------|---------|
| As 5 : 40 :: 2.5 | 80      |
| 40               | 40      |
| 5) 100.0         | Sum 120 |
| 10 or 80—20=60.  | 60      |
| 00               | 00      |

## QUEST. IV.

Three Men, as *A*, *B*, and *C*, bought a Ship for 200 *l*. *A* says to *B*, give me half your Money, and I will pay for the Ship; *B* says to *C*, give me  $\frac{1}{3}$  of your Money, and I will pay for the Ship; *C* says to *A*, give me  $\frac{1}{4}$  of your Money, and I will pay for the Ship; what Sum of Money had each? Answer *A* 128, *B* 144, *C* 168.

|                   |                               |
|-------------------|-------------------------------|
| 1 Sup. 120—50     | 128 + $\frac{1}{2}$ 144 = 200 |
| 2 Sup. 130 + 12.5 | 144 + $\frac{1}{3}$ 168 = 200 |
|                   | 168 + $\frac{1}{4}$ 128 = 200 |

## QUEST. V.

Three Men, as *A*, *B*, and *C*, thus discoursed of their Money; *A* saith to *B* and *C*, give me half your Money, and I shall have 100 *l*. *B* saith to *C* and *A*, give me one third of your Money, and I shall have 100 *l*. *C* saith to *A* and *B*, give me one fourth of your Money, and I shall have 100 *l*. What had each?

This Question will require more Suppositions than two, before it can well be wrought by this Rule; which may convince some that affirm, if a Question require more Suppositions than two, it will not be wrought by the Rule of False: but the contrary may be seen in the following Work.

Let the first general Supposition for *A*, be 20 *l*. then he wanted 80 *l*. which is the half of *B* and *C*'s Money; then *C* must have 120 *l*. Now *B* will have of *C* and *A*'s  $\frac{1}{3}$  of their Money, which is 46  $\frac{2}{3}$  *l*. which added to *B*'s Money 40 *l*. makes

makes  $86\frac{2}{3}$ , which should be 100 l. So we have supposed too little for  $B$  by  $13\frac{1}{3}$ , for 100 less  $86\frac{2}{3} = 13\frac{1}{3}$ .

Suppose again  $B$  had 70 l. then  $C$  must have 90 l. Now  $B$  will have of  $C$  and  $A$   $\frac{1}{3}$  of their Money, which is 66  $\frac{2}{3}$ ; which added to  $B$ 's Money 70 l. makes 136  $\frac{2}{3}$ , which should be 100 l. Here we have supposed too much for  $B$  by  $6\frac{2}{3}$ .

Now say, according to the Rule As 20 : 30 :: 6  $\frac{2}{3}$  : 10, and 10 subtracted from 70, resteth 60 for  $B$ ; then if  $A$  had 20,  $B$  had 60,  $C$  100.

But the Question saith,  $C$  will have of  $A$  and  $B$   $\frac{1}{2}$  of their Money, which is 20 l. which added to 100 l. of  $C$ 's Money, makes 120, which should be 100 l. Therefore our Supposition for  $A$  is too little by 20 l.

Let the second general Supposition for  $A$  be 30 l. then he wanted 70 l. therefore 70 l. is the half of  $B$ 's and  $C$ 's Money; then they must have 140 l. whereof we suppose  $B$  had 30 l. then must  $C$  have 110 l. Now  $B$  will have of  $C$  and  $A$ , one third of their Money, which is 46  $\frac{2}{3}$ , which added to 30 l.  $B$ 's Money, makes 76  $\frac{2}{3}$ , which should be 100 l. Here we have supposed too little for  $B$  by  $23\frac{1}{3}$ .

S. 1 = 30 — 23  $\frac{1}{3}$   $B$ .

Suppose again,  $B$  had 50 l. then must  $C$  have 90 l. Now  $B$  will have of  $C$  and  $A$  one third of their Money, which is 40 l. which added to  $B$ 's Money 50 l. makes 90 l. which should be 100. Here we have supposed too little for  $B$  by 10 l.

S. 1 = 30 — 23  $\frac{1}{3}$   $B$ .  
S. 2 = 50 — 10  $B$ .

Then say, if  $13\frac{1}{3} : 20 :: 10 : 15$ , and 15 added to 50 makes 65 for  $B$ . Then if  $A$  had 30,  $B$  would have 65, and  $C$  75.

But the Question saith,  $C$  will have of  $A$  and  $B$   $\frac{1}{3}$  of their Money, which is 23  $\frac{1}{3}$ , which added to 75 of  $C$ 's Money, makes 98  $\frac{1}{3}$ , which should be 100 l. therefore our second Supposition for  $A$  is too much by  $1\frac{1}{3}$ . S. 2 = 30 + 1  $\frac{1}{3}$   $A$ .

S. 1  $A$  = 20 — 20  
S. 2  $A$  = 30 — 1  $\frac{1}{3}$

Now

Now I say, if  $21\frac{1}{7} : 10 :: 20 : 9\frac{2}{7}$ , and  $9\frac{2}{7}$  added to 20, give  $29\frac{2}{7}$ , for the true Share of *A*.

Seeing then that *A* hath  $29\frac{2}{7}$ ; he wanteth  $70\frac{1}{7}$ , which is half *B*'s and *C*'s Money; then they must have  $141\frac{3}{7}$ , whereof suppose *B* had  $30\frac{1}{7}$ , then *C* had  $111\frac{2}{7}$ . Now *B* will have of *C* and *A*  $\frac{1}{3}$  of their Money, which is  $46\frac{4}{7}$ , which added to his own Money  $30\frac{1}{7}$  makes  $76\frac{4}{7}$ , which should be 100 *l*. Here we have supposed too little for *B* by  $23\frac{2}{7}$ .  $S. 1 = 30 - 23\frac{2}{7} B.$

Suppose again, *B* had 65 *l*, then *C* had  $76\frac{3}{4}$ ; now *B* will have of *C* and *A* one third of their Money, which is  $35\frac{3}{4}$ , which added to his Money 65 *l*, makes 100  $\frac{3}{4}$ , which is too much by  $\frac{1}{4}$ .  $S. 2 = 65 + 0\frac{3}{4} B.$

$$S. 1 = 30 - 23\frac{2}{7} B,$$

$$S. 2 = 65 + 0\frac{3}{4} B.$$

Then say, as  $23\frac{2}{7} : \text{to } 35 :: \text{so is } \frac{1}{4} \text{ to } \frac{5}{7}$ ; which subtracted from 65, leaves  $64\frac{12}{7}$ , for *B*'s true Share; then must *C* have  $76\frac{8}{7}$ .

Their Parts  $\left\{ \begin{array}{l} A = 29\frac{2}{7} \\ B = 64\frac{12}{7} \\ C = 76\frac{8}{7} \end{array} \right\}$  In Decimals.  $\left\{ \begin{array}{l} A = 29.4117647 \\ B = 64.7058824 \\ C = 76.4705882 \end{array} \right.$

Proof  $\left\{ \begin{array}{l} 29\frac{2}{7} + \frac{1}{2} \left\{ \begin{array}{l} B 64\frac{12}{7} \\ C 76\frac{8}{7} \end{array} \right\} = \text{to } 70\frac{1}{7}, = 100 \text{ for } A. \\ 64\frac{12}{7} + \frac{1}{3} \left\{ \begin{array}{l} C 76\frac{8}{7} \\ A 29\frac{2}{7} \end{array} \right\} = \text{to } 35\frac{3}{4}, = 100 \text{ for } B. \\ 76\frac{8}{7} + \frac{1}{4} \left\{ \begin{array}{l} A 29\frac{2}{7} \\ B 64\frac{12}{7} \end{array} \right\} = \text{to } 23\frac{2}{7}, = 100 \text{ for } C. \end{array} \right.$

This Question is not capable of an exact Answer in *English* Coin, as you may see: But if you would have an Answer in Integers, you must make the common Sum in this Question 100 *l*. some Multiple or 17; or if you reduce their Shares into improper Fractions, then

*A* will have  $\frac{180}{17}$

*B* will have  $\frac{1100}{17}$

*C* will have  $\frac{1100}{17}$

And



*Questions in the Rule of False.* 313

And seeing the Denominators are equal, neglect them, and the Numerators will be proportional Numbers for *A*, *B*, *C*, which you abbreviate into lesser, by cutting two Cyphers from each; then will *A* have 5*l.* *B* 11*l.* and *C* 13*l.* Then if *A* have half of *B* and *C*'s Money, he will have 17*l.* If *B* have one third of *C*'s and *A*'s Money, he will have 17*l.* And if *C* have one fourth of *A*'s and *B*'s Money, he will have 17*l.* So this Question consisteth all of Integers; and 17*l.* falls into the Place of 100*l.*

I have been the longer upon this Question, that the Learner may observe the Variety of Work that may proceed from such like Questions.

Here I have annexed two or three more, with their Answers, which may serve for the Learner's Exercise, and so conclude this Rule.

*Questions in the Rule of False.*

QUEST. I.

What Number is that, which multiplied by 20, and divided by 6, gives 140 in the Quotient? *Facit* 42.

QUEST. II.

What Number is that, which added to its half and its one fourth, and to 3 more, makes 108? *Facit* 60.

QUEST. III.

A Vessel that holdeth 60 Gallons, hath 4 Cocks, and being filled with Water or any other Liquor, if they all be set open at once, the Liquor will run out in 24 Hours. Now the second Cock will empty twice as much as the first during the same time; and the third will empty three times as much as the first in the same time; and the fourth will empty 5 times as much as the first. What Number of Gallons doth each Cock empty?

*Facit*, the first  $5\frac{4}{11}$  Gallons, the second,  $10\frac{8}{11}$  Gallons, the third,  $16\frac{4}{11}$  Gallons, the fourth  $27\frac{3}{11}=60$  Gallons.

QUEST. IV.

A Gentleman hired a Workman for 40 Day, and agreed for every Day he worked he should have 8 Pence, and every Day he play'd, he should return back 4 Pence. At

314 *Questions in the Rule of False.*

the End of 40 Days the Labourer received 10 s. 5 d.  
How many Days did he play? *Facit* 16 Days, and one Quarter.

*QUEST. V.*

A young Man coming into a Garden, saith, bless you all, you 10 fair Maids! Sir, you mistake yourself, saith one, for we are not 10; but if we were thrice as many as we are, we should be as many above 10 as now we are less. How many were there? *Facit* 5 Maids, or rather Maidens.

*QUEST. VI.*

What Numbers are they whose  $\frac{2}{3}$  of the one, = suppose *A*, is equal to  $\frac{1}{4}$  of the other *B*? *Facit* *A* 72, *B* 105.

*QUEST. VII.*

Suppose there are two Numbers, *A* and *B*, the lesser of which, to wit *A*, hath such Proportion to the greater, to wit *B*, as  $2\frac{1}{2}$  to 6, and the Sum of the said Numbers hath such Proportion to the Sum of the Square of the same Numbers, as  $5\frac{1}{2}$  to  $68\frac{1}{2}$ ; I demand each Number? *Facit* 7 for *A*, and 15 for *B*.

*QUEST. VIII.*

Divide 45 into two such Parts, that the greater may be in triple Proportion to the less; What are those Parts? *Facit*  $11\frac{1}{4}$ , and  $33\frac{1}{4}$ .

*QUEST. IX.*

Divide 10 into two such Parts, as if the greater be divided by the lesser, the Quotient may be 20; what are both Parts? *Facit*  $\frac{10}{21}$ , and  $9\frac{11}{21}$ .

*QUEST. X.*

A Vessel of 63 Gallons was filled with French Wine of two Sorts; the one at 2 s. the Gallon, and the other at 2 s. 6 d. The Wine in the Hogshead thus filled did cost 7 l. 4 s. How much was there of each Sort? *Facit* 27 Gallons of 2 s. and 36 of 2 s. 6 d.

*QUEST.*

QUEST. XI.

A Gentleman bought a House with a Garden, and a good Horse in the Stable, for 500  $\text{l}$ . Now he paid 4 times the Price of the Horse for the Garden, and 5 times the Price of the Garden for the House: What did the House, Garden, and Horse cost?

*Answer.* The House 400  $\text{l}$ . the Garden 80  $\text{l}$ . the Horse 20  $\text{l}$ .

*Note.* Some of the foregoing Questions may be wrought by the *Single Rule of Falsse*; though notwithstanding they may be wrought by two Suppositions, as you may try at your Leisure. And to conclude, any Question whatsoever, if not impossible, may be resolved; if by comparing, adding, subtracting, or Proportion, you could prove your Question, if the true Resolution was given; for otherwise the Question cannot be resolved, because you cannot come to know what the Errors were at the Positions; but then they must be wrought by *Algebra*.

In the next Place, we shall proceed to *Logarithmical Arithmetick*; and in that shall be very concise: Their chiefest Use in Arithmetick being in resolving Questions concerning *Compound Interest* and *Annuities*.

LOGARITHMICAL ARITHMETICK.

**L**OGARITHMS are artificial Numbers which differ equally, fitted to the natural; for Ease in Calculation.

The first Figure, called the *Index*, or *Characteristick*, shews how many Figures the answering Number consists of, which are always more by one than the Index, if the same be whole.

So the Index of any Number under 10, is (0); betwixt 10 and 100 (1); betwixt 100 and 1000 is (2), &c.

The Logarithm of a Fraction, or Decimal Number, is all one as an Integer, only with this Difference for the

S f

Index,



Index, that if the first Figure of the Decimal to the Left-hand be significant, the Index is (.9); If there be one Cypher before it, the Index is (.8), &c.

## EXAMPLE.

| IV. Numb. | Logarithms. | Defect. Numbers. | Logarithms. |
|-----------|-------------|------------------|-------------|
| 2345      | 3.3701428   | .2345            | .9.3701428  |
| 234.5     | 2.3701428   | .02345           | .8.3701428  |
| 23.45     | 1.3701428   | .002345          | .7.3701428  |
| 2.345     | 0.3701428   | .0002345         | .6.3701428  |

Thus may you see the Logarithms are the same, but the Index thereof differeth, according as the first Figure thereof is removed from Unity.

## Construction of Logarithms.

Their Construction, according to the common Rules, given by many Extractions of Roots, is tedious; the best Way yet known is this, which follows.

## To make a Table of Logarithms.

First, Put for the Logarithm of 1, a Cypher for the Index, and a competent Number of Cyphers for the Logarithm, according to the Number of Places you would have your Logarithms consist of; for 10 an Unit, with the same Number of Cyphers; for 100, 2, with as many Cyphers; for 1000, 3, with as many Cyphers, &c.

Secondly, Find the Difference between some two Logarithms, above 1000, or rather above 10000, that differ by Unity; thus, Multiply the two Numbers together, and that Product you must multiply again by 43429448190-325183896; which last Product divided by the Arithmetical Mean between both Numbers, the Quotient is the Difference sought.

Suppose we would find the Difference between the Log. 10000 and 10001, the Product of these two Numbers is 1.00010000, which multiplied by 4343 produceth 43434343; this divided by 10000.5, quotes 4343. Now if to the Logarithm of 10000, which is 4.0000000, you add

## To find a Logarithm by the Tables. 317

add the Difference before found, to wit, 4343, the Sum 40000434 is the true Logarithm of 10001 to 7 Places.

*Thirdly*, Having thus found the Difference of any two Logarithms Difference by Unity, and consequently some of the Logarithms by dividing the Difference found by the arithmetical Mean, between any two Numbers Difference by Unity, you shall have the Difference of the Logarithm of those two Numbers.

Thus to find the Difference between the Logarithm of 274 and 275; divide 4343, the Difference of the Logarithm of 10000, and 10001 by 274.5, the Quotient 15821, is the Difference sought.

*Fourthly*, Having by this Means found a few of the prime Logarithms, the rest are made by Addition and Subtraction; and, having made the Canon upward, above 1000 to 10000, by consequence 'tis made for all inferior Numbers.

The prime Numbers to which Logarithms must be found in the first Place, are these, 2 . 3 . 7 . 11 . 13 . 17 . 19 . 23 . 29 . 31 . 37 . 41 . 43 . 47 . 53 . 59 . 61 . 67 . 71 . 73 . 79 . 89 . 97, &c. or the same Numbers with Cyphers. There being several Tables of Logarithms, we shall only explain those, which in this Place we have made use of, which are Mr. *Oughtred's* in his *Trigonometry*, they being of as good, if not a better Character than any extant; and the Logarithms extended to 7 Places after the Index. Of the same Sort are Mr. *Gunter's*, Mr. *Norwood's*, Mr. *Leyburn's*, &c. But we must do Mr. *Briggs* that Justice, to say, they are all from his Original Table.

The Logarithm of any Number under 10000, is found by Inspection; so the Logarithm of 1234 is 3.0913151; but if your Number given consists of 5 or 6 Places, then you must use Proportion: Thus seek for the first 4, as before, noting the Difference betwixt that Logarithm and the next greater; then say, As 10, if your Number consists of 5 Places, or as 100, if of 6 Places: To the said Difference :: So the Figure, or Figures wanting to the Part proportional, which added to the Logarithm before found, the Sum (when a true Characteristick or Index is fitted): To the Logarithm of the Number sought.

So the Logarithm of 12345 is 4.0914910 } &c.  
And of 12356 is 4.0918778 }

To find the Number answering a Logarithm given, is but the Converse; the first four Figures are found by Inspection: But if you want for 5 or 6 Places, do thus; seek the Logarithm next less, and against it are the four first Figures; then seek the Difference betwixt that and the next greater, as likewise betwixt the given Logarithm and the next less, and say, as the first Difference: To 10, if for 5 Figures, or to 100, if for 6 Places: So the other Difference: To the remaining Figure or Figures sought.

So the Number answering 4.0918778 is = 12356, as above.

### Addition of Logarithms.

In Addition take this general Rule.

#### A General Rule.

If your Indices be affirmative, add them as usual, and you have the true Sum.

But if they be negative, add them as before; only note, That if the Sum of the Indices be under 10, add 10; if just 10, add Unity; if above 10, cast 10 away, the Sum, or Remainder, will be negative.

But if the Indices be of different Kinds, that is, one affirmative and the other negative, add them also.

If the Sum be 10, or above, cast away 10, the Remainder is affirmative; if under 10, negative.

#### E X A M P L E S.

I. Unto 2.2671717  
Add 3.1414498

Sum = 5.4086215

III. Add { 2.2671717  
          { 9.1414498  
          { 8.8750613

Sum = 0.2836828

II. Unto 3.2671715  
Add 5.1414498

Sum = 18.4086213

IV. Add { 9.1414498  
          { 7.2671717  
          { 8.8750913

Sum = 5.2837128



## Subtraction of Logarithms. 319

### More EXAMPLES.

V. Unto 2.2671717

Add 3.1414498

Sum = 0.4086215

VI. Unto .9.2671717

Add 3.1414498

Sum = 2.4086215

In the adding of these Logarithms there is no Difficulty, excepting in the second, which may appear abstruse, where the Sum of the Indices is .18; which shews there is 11 Cyphers before the first significant Figure, the 10 of which signifies 10 Cyphers, and the 8 being defective, always is the Sign of one Cypher before the first significant Figure, as was noted before.

And now we shall proceed to *Subtraction*.

## Subtraction of Logarithms.

### A General Rule.

If your Indices be affirmative, and the higher the greater, then as usual.

If one or both be negative, observe if the Index of the higher be smaller than the lower, if it be, add 10 to it; and if the higher be of greater Value, the Remains are affirmative; if not, they are negative.

### EXAMPLES.

I. From 3.1414498

Subtract 2.2671717

Rest 0.8742781

III. From .9.2671717

Subtract 3.1414498

Rest .6.1257219

II. From 2.2671717

Subtract 3.1414498

Rest .9.1257219

IV. From 3.1414498

Subtract .9.2671717

Rest 3.8742781

V.

## 320 *Multiplication of Logarithms.*

V. From .8.8750613  
Subtract .9.1414498

VI. From .9.1414498  
Subtract .8.8750613

Rest .9.7336115

Rest .9.2663885

In these there is nothing obscure.

## *Multiplication of Logarithms.*

To multiply one Number by another, is nothing but to add their Logarithms together, their Sum is the Logarithm of their Product.

### *E X A M P L E S.*

I. Multiply 144 By 12 Log. 2.1583625 } Add  
Log. 1.0791812 }

Product 1728 Log. 3.2375437  
II. Mult. 1385 By 185 Log. 3.1414498 } Add  
Log. 2.2671717 }

Prod. 256225 Log. 5.4086215  
III. Mult. 1385 By .0185 Log. 0.1414498 } Add  
Log. 8.2671717 }

Prod. 256225 Log. 8.4086215  
IV. Mult. 138.5 By 18.5 Log. 2.1414498 } Add  
Log. 1.2671717 }

Prod. .2562.25 Log. 3.4086215  
And so of any other.

## *Division in Logarithms.*

To divide one Number by another, is nothing but to subtract the Logarithm of the Divisor from the Logarithm of the Dividend, the Remainder is the Logarithm of the Quotient.

*E X.*

# Division in Logarithms.

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This may be performed by Addition; thus; Add the  
**E. X. M. P. L. E.**  
 I. Divide 1728 Log. 3.2375435  
 By 12 Log. 1.0791812 } Subtract  
 Quotient 144 Log. 2.1583625  
 II. Divide 256225 Log. 5.4086215  
 By 185 Log. 2.2671717 } Subtract  
 Quotient 1385 Log. 3.1414498  
 III. Divide 62225 Log. 4.7958815  
 By 1385 Log. 4.1414498 } Subtract  
 Quotient 10185 Log. 4.2671717  
 IV. Divide 236225 Log. 2.4086215  
 By 1385 Log. 2.1414498 } Subtract  
 Quotient 185 Log. 0.2671717  
 And thus of any other.

## Golden Rule in Logarithms.

In this Rule we have 3 Numbers given, to find a  
 Fourth; wherefore if your Question be direct, work  
 thus: Add the Logarithms of the Second and Third, and  
 from that Sum subtract the Logarithm of the First, the  
 Remainder is the Logarithm of the 4th Proportional  
 sought.

### EXAMPLE.

If 13 Gros of Ince cost 7 £ 12 s. what will 66 1/2 cost?

**Be the Work.**

If 13 Gros, Log. 1.1139434

Cost 7.6, Log. 0.8808136

What 66.5 Gros, Log. 1.8228216

2.7036352

Log. = 1.5896918

This

Answer, 38.8769.



This may be performed by Addition, thus; Add the Arithmetical Complement of the Logarithm of the First unto the Logarithm of the Second and Third, the Sum is the Logarithm of the Fourth.

*Arith. Comp.* 13. .88860566  
7.6 .08808136  
66.5 .18218216

The Arithmetical Complement is only the Remainder of every Figure to 9, and the last to 10. So the Arithmetical Comp. of 0.88860566 is 9.11139434, of 2.00000000 is 8.00000000. Here you may see the Answer is the same as it was before.

But if your Question be Inverse, work thus; add the Logarithm of the First and Second together, and from that Sum subtract the Logarithm of the Third, the Remainder is the Logarithm of the fourth Proportional sought.

*E X A M P L E.*

If 12 Men do a Piece of Work in 20 Days, in how many Days will 60 Men do the same Work?

*The Operation.*

If 12 Men, Log. 1.0791812  
Require 20 Days, Log. 1.3010300

The Sum 2.3802112  
What will 60 Men require? Log. Sub. 1.7781512

Answer, 4 Days. Log. 0.6020600

This may likewise be performed by Addition, by adding the Arithmetical Complement of the Logarithm of the Third, to the Logarithm of the First and Second; the Sum is the Logarithm of the Fourth.

Thus, If 12 Men, Log. 1.0791812  
Require 20 Days, Log. 1.3010300  
What will 60 Men require, *Arith. Comp.* 8.2218488

Answer, 4 Days, as before, Log. 0.6020600  
And so in any other.

Whence

# 324 **Extraction of the Square Root**

When any number is divided by another, the Quotient is the Logarithm of the Dividend, and the Logarithm of the Divisor, subtracted from the Logarithm of the Dividend, the Remainder is the Logarithm of the Product.

Like-wise in Division, instead of subtracting one from the other, you may add the Arithmetical Complement of the Logarithm of the Divisor to the Logarithm of the Dividend, the Sum is the Logarithm of the Quotient.

11226, 4 = 0.028318

## **Extraction of the Square Root**

Though Extraction of Roots by natural Numbers, is one of the difficultest Parts of Arithmetick, yet by artificial Numbers or Logarithms, nothing is more easy and plain, as may be seen in the Practice thereof.

To extract the Square Root of any Number, is perform'd by parting or halving its Logarithm; the said Half

is the Logarithm of the Root sought.

What is the Square Root of 12? Log. 1.0791812

Half is .5395906  
 Which is the Logarithm of 12, the Root sought.

E X A M P L E

Let it be required to find the Square Root of 160.

Log. of 160 is 2.2041200  
 Half is the Logarithm of 12.6491

Which is the Side of a Square, and true to 4 Places of Decimals; which is exact enough for common Use, 160 being a Surd Number, its true Root is inexpressible.

Note, If the Number whose Root is sought be a Decimal, add 10 to the Index, and divide it by 2 in this

E X A M P L E

What is the Square Root of .225? Log. 19.3521812

Half is 9.6760906

Which is the Logarithm of .4743, the Root sought.

T t And

### 324 *Extraction of the Cube Root.*

And seeing halving the Logarithm of any Number gives the Logarithm of its Root, then it follows, that multiplying the Logarithm of any Number by 2, gives the Logarithm of the Square thereof, and may be seen in this Example.

#### *EXAMPLE IV*

What is the Square of 11826? Its Log.  $4.0728378$

Multiply by 2

Which is the Logarithm of 13985426 = 8.1456756

Proof is its Root, viz. 11826,  $\frac{1}{2} = 4.0728378$

This Number 13985426 is a very remarkable Number: First, It is a square Number; Secondly, it contains 9 Places, and they are 9 Digits, and I think there is not another that does.

#### *Extraction of the Cube Root*

As the Square Root is found by Bisection, or halving its Logarithm, so the Cube Root is found by Tripartition, or taking one third Part of its Logarithm, which will be the Logarithm of the Cube Root sought.

#### *EXAMPLE I*

What is the Cube Root of 1728?  $12$

The Logarithm of 1728, is  $3.2375437$

One Third of this is  $1.0791812$

Which is the Logarithm of 12, the Root sought.

#### *EXAMPLE II*

What is the Cube Root of 123456?  $50.915121$

Its Logarithm is  $5.0915121$

One Third thereof is  $1.6971707$

Which is the Logarithm of 49.7932, the Cube Root sought.

If your Number be a Decimal, add 20 to its Index, and take  $\frac{1}{3}$  as before.

So the Cube Root of .256, its Log.  $29.4082206$

will be .6350

Hence



## Proportions in Logarithms.

Hence if you have a mind to cube any Number, you must multiply its Log. by 3, and you have the Logarithm of its Cube; so the Cube of 9 will be found to be 729.

which is the Log. of 729 = 2.862779.

## Proportions in Logarithms.

To find a mean Proportional between two Numbers.

**RULE.**

Add the Logarithm of the two Numbers into one Sum, the 1/2 of which is the Logarithm of the mean Proportional sought.

### EXAMPLE.

Let the two Numbers be 16 and 144, and let a mean Proportional be required.

Log. of 16 is

Log. of 144 is

Their Sum

Half of which is

Which is the Logarithm of 48, the mean Proportional sought.

*Note.* If one be a Decimal, if the Sum of the Indices be 10, or above, cast away 10 and then halve it; if it be not 10, add 10 to it, and then halve it.

So a mean Proportional betwixt 12 Log.

And 25 Log.

The Sum

Will be 1.732

Between two Numbers given, to find any Number of mean Proportionals desired.

### RULE.

Subtract the Logarithm of the less Number out of the Logarithm of the greater, the Remainder divided by a Number greater by one than the Number of Means

T t 2

sought;

# 326 Proportions in Logarithms.

ought; this Quotient added to the Logarithm of the less Number, is the Sum, or the Logarithm of the first Mean; to which adding again the said Quotient, the Sum is the Logarithm of the second Mean, and so on, and as far as you have occasion.

## EXAMPLE.

Between 16 and 64 find five mean Proportionals.

Log. of 64 is 1.8061800

Log. of 16 is 1.2041200

The Difference is 0.6020600

Part for 5 Means is 0.1003433

To which add the Log. of 16 1.2041200

The Sum is the Log. of the 1st Mean 20.1581.3044633

To which add again 1.003433

The Sum of the Log. of the 2d Mean 25.3981.4048066

To which add again 1.003433

The Log. of the 3d Mean 32 1.5081499

To which add again 1.003433

The Log. of the 4th Mean 40.3171.6084932

Unto which add again 1.003433

The Log. of the last Mean 50.7961.7088365

This Proposition is of excellent Use in the Calculation of Tables belonging to Compound Interest, as shall be shewn in due Place.

Having three Numbers given, to find a fourth in a duplicated Proportion.

RULE.

Double the Difference of the Logarithm of those two Numbers which have the same Denomination; then according as the first Term is less, or greater than the second, add or subtract the double Difference to, or from, the Logarithm of the third Number; this done, the Sum or Remainder is the Logarithm of the 4th Number sought.

EXAMPLE.

Let 16 be the first Term, 64 the second, and 20 the third.

Log. of 16 is 1.2041200

Log. of 64 is 1.8061800

The Difference is 0.6020600

Double the Difference is 1.2041200

To which add the Log. of 20 1.3010300

The Sum is the Log. of the 4th Number 25.3981.4048066

The 4th Number is 25.3981.4048066

# Proportions in Logarithms

**E X A M P L E**  
 If the Content of a Circle, whose Diameter is 7 Inches, be 38.484; what is the Content of that Circle, whose Diameter is 21? *Answer* 346.3561.

*See the Work.*

Diameter 7 Inches, Log. 0.8450989

Diameter 21 Inches, Log. 1.3222193

Difference is 0.4771213

Difference doubled 0.9542426

Content given, 38.484 Log. 1.583862

Content required, 346.3561 Log. 2.5395228

By this Proposition we find the Proportion betwixt like Superficies, which, by *Euclid* the 6th and 10th and 20th, is proved to be in duplicate Proportion of their Homologous Sides.

So if a Field, measured by a Statute Perch, contain 36 Acres, it would, if measured by a *Cheshire* Perch, of 24 Feet to the Pole, be found to contain but 12 Acres, and so on.

Having these Numbers given, to find a Fourth, in a triplicated Proportion.

**R U L E**

Triple the Difference of the Logarithm of those two Numbers, which have the same Denomination; then, according as the first Term is lesser or greater than the 2d, add or subtract the tripled Difference to, or from the Logarithm of the other Number; this done, the Sum or Remainder is the Logarithm of the 4th Number sought.

**E X A M P L E**

If a Bullet, whose Diameter is 9 Inches, do weigh 72 Pound; what will a Bullet of the same Metal weigh, whose Diameter is 6 Inches?

Diameter



# 328 *Military Orders by the Logarithms.*

Diameter 9 Inches, Log. 0.9542425  
 Diameter 6 Inches, Log. 0.7781512

Difference is 0.1760913  
 Difference tripled 0.5282739  
 Weight given 72 lb. Log. 1.8573325

Weight required 21  $\frac{1}{2}$  1.3290586

By this Proposition we find the Proportion between like Solids; for as like Superficies do hold in a duplicated Proportion; so like Solids do hold in a triplicated Proportion of their Homologous Sides, Diameters, &c. In the next Place, we shall give a few Propositions in *Military Orders*, and then proceed to our chief Design, which is *Compound Interest*.

By this Proposition we find the Proportion between like Superficies, which by *Arithmetical* the 10th and 11th is proved. *Military Orders by the Logarithms* is proved.

So if a Field, measured by a Statute Pole, contain 36 Acres, it would, if measured by a Military Pole, of 24 Feet to the Pole, be found to contain but 12 Acres. Any Number of Soldiers being given, to place them in a square Battalia of Men.

Having these Numbers given, to find a Fourth, in a duplicated Proportion. **R U L E.**

One half of the Logarithm of the Number of Soldiers given, will be the Logarithm of the Number of Men, both in Rank and File, to make a square Battalia of Men.

Numbers, which have the same Denomination; then, according as the 1st Term is less or greater than the 2d, add or subtract the Logarithm of the 3d, or from the Logarithm of the 2d Number; thus done the Sum is the Logarithm of the 4th Number.

Let 1764 Men be given, and let it be required to frame them in a square Battalia.

Log. of 1764 is 3.2464986  
 is 1.6232493

which is the Logarithm of 42, which is the Number of Men that must be placed both in Rank and File to make a square Battalia of Men.

**P R O P.**

# Military Order by the Legislature 3092

## PROPOSITION

Any Number of Men being given, to order them into a double Battalion; that is, that shall have twice as many in Rank as File.

## RULE

Half the Logarithm of the Number of Men, in the Logarithm of the Number of Men to be placed in File; and that Number doubled, is the Number to be placed in Rank.

## EXAMPLE

Let the Number of Men be 8450, and let it be required to make a double Battalion of them. Half the given Number of Men is 4225. Log. 3.6258207 The Half of which is 2112.5, which is the Logarithm of 65; and so many must be placed in File, which doubled makes 130, which is the Number of Men to be placed in Rank; for 65 times 130 is equal to 8450, the Number of Men given.

## PROPOSITION

Any Number of Soldiers given, to order them into a quadruple Battalion of Men; that is, that shall have 4 times as many in Rank as File.

## RULE

Half the Logarithm of one Quarter of the Number of Soldiers given, is the Logarithm of the Number of Men to be placed in File; which Number multiplied by 4, is the Number to be placed in Rank.

Let the given Number of Men be 4000 to be ordered into a quadruple Battalion.

One Quarter of which Number is 1000. Log. 3.0000000

The Half of which is 1.5440680

which is the Logarithm of 35, the Number to be placed in File, which multiplied by 4, gives 140, which must be the Number to be placed in Rank.

## PROPOSITION

# 390c Military Data by the Logarithm.

## P R O P O S I T I O N IV.

Any Number of Men being given, to order them into three equal Square Battalions.

## R U L E.

Half the Logarithm of the Number of Soldiers given, is the Logarithm of the Number to be placed both in Rank and File in every Battalion.

## E X A M P L E.

Let the given Number of Soldiers be 6075, and let it be required to form 3 Square Battalions of them, that shall have an equal Number of Men, both in Rank and File.

One third of 6075 is 2025, its Log.

The Half of which is 1012.5, which is the Logarithm of 45, the Number of Men in each Battalion that must be placed both in Rank and File.

## P R O P O S I T I O N V.

Any Number of Soldiers given, to place them in Rank and File, according to the Proportion of any two Numbers given.

## R U L E.

From the Sum of the Logarithms of the Number of Soldiers given, and the Proportional Number for the Rank, subtract the Logarithm of the Proportional Number of Files, half the Remainder is the Logarithm of the Men to be placed in Rank, and the same Logarithm subtracted from the Logarithm of the whole Number of Soldiers, leaves the Logarithm of the Number to be placed in Files.

## E X A M P L E.

Let 300 Soldiers be to be placed, that the Number in File may be to those in Rank, as 5 to 9.



# Military Orders by the Logarithms. 331

The Log. of 3600 is 3.5563025  
 The Log. of 9, the Prop. of Rank is 0.9542425

The Sum is 4.5105450  
 Log. of 5, Prop. for File is 0.6989700

Difference is 3.8115750  
 Half of which is 1.9057875

which is the Logarithm of 80, nearest the Number in Rank; and the last Log. subtracted from the first, leaves the Log. of the File, to wit, 1.6505150; the Log. of 44, nearest the Number in File.

## PROP. V.

Any Number of Soldiers given, with their Distance in Rank and File, to order them into a square Battalia of Ground.

## RULE.

From the Sum of the Log. of the Number of Soldiers, and of the Distance in Rank, subtract the Logarithm of their Distance in File, half of the Remainder is the Number in File: which Logarithm subtract from the Logarithm of the whole Number of Soldiers, the Remainder is the Logarithm of the Number of Soldiers to be placed in Rank.

## EXAMPLE.

Let 3600 Soldiers be ordered into a square Battalia of Ground, so that the Distance in File may be 7 Feet, and in Rank 3 Feet; so that the Ground they stand upon may be a true Square.

The Logarithm of 3600 is 3.5563025  
 Log. of 3, the Distance in Rank is 0.4771212

The Sum is 4.0334237  
 Log. of 7, the Distance in File is 0.8450980

Difference is 3.1883257  
 Half of which is 1.5941628

which is the Logarithm of 39 nearest for the Number of Men in File; and the last Logarithm subtracted from the first Logarithm leaves 1.9621397, which is the Logarithm of 92 nearest the Number of Men in Rank.

More might be added, but these are sufficient.

## Compound INTEREST

**W**HEN a Sum of Money is lent, and the Interest, when due, is not paid, but kept in the Borrower's Hands, and by that means becomes a Part of the Principal, then it is called *Compound Interest*.

As if *A* lend to *B* an 100*l.* at the Rate of 6 per Cent. for a Year, then it is evident that at the End of one Year, *B* is got into *A*'s Debt 106*l.* and if this be continued in *B*'s Hand till the End of the second Year, there will then be due to *A* the Increase of 106, viz. 112*l.* 7*s.* 2*d.*  $\frac{1}{2}$ , which will be a new Stock for the third Year, if not paid at the second Year's End.

Whereby it is plain, that if it be lawful to take Interest at all, it is lawful to take Compound Interest: For if *A* had received this Interest annually as it became due, he had the Advantage of putting out those annual Payments at the same Rate, and none would have filed it Compound Interest. This will yet appear more plain, by supposing *A* laid out his 100*l.* in purchasing an annual Rent of 6*l.* clear Value, which annual Rent may be made use of to his best Advantage, and none call him an Extortioner.

And lastly it will appear, that for any Time under a Year, Compound Interest is more easy than Simple; for he that takes 3*l.* for the Use of an 100*l.* for one half Year, takes too much; which may be proved thus: For as Simple Interest was performed by a Rank of Numbers arithmetically proportional; so Compound Interest is performed by a Rank of Numbers geometrically proportional.

And it is to be known, that if three Numbers be in Geometrical Proportion, the Product of the two Extremes is equal to the Square of the Mean, by the 20th of the 7th of *Euclid*. So on the contrary, if the Rectangle contained under the Extremes of any three Numbers be equal to the Square of the Mean, then those three Numbers are in Geometrical Proportion.

Now

Now if 3*l.* be the Interest of 100*l.* for a half Year, or six Months, then these three Numbers 100, 103, 106, should be in Geometrical Proportion; but it may be proved by the aforesaid Proposition they are not: For the Rectangle of 100 and 106 is but 10600, and the Square of the Mean 103, is 10609. But if the Square Root of 10600 be sought, it will be found to be 102.956: So that the true Proportional Interest of 100*l.* for 6 Months, or half a Year, is but 2*l.* 19*s.* 1*d.*  $\frac{1}{2}$  *ferd.*

In the Solution of Questions of Compound Interest, four Things are to be considered.

*First*, The Principal, or Money lent.

*Secondly*, The Time of Forbearance, in Years, or Parts of a Year.

*Thirdly*, The Rate of Interest *per Cent.* by the Year, half Year, or Quarter, &c. Equal to 1.06, 1.08, &c.

*Fourthly*, The Amount of the said Principal for the said Rate and Time.

Any three of these being given, to find the Fourth, as in the four Propositions following.

**P R O P O S I T I O N I.**

Principal, Rate, and Time given, to find the Amount

**R U L E.**

Unto the Logarithm of the Rate multiply'd by the Time, add the Logarithm of the Principal, the Sum is the Logarithm of the Amount.

**E X A M P L E.**

What will 20*l.* amount to, forborn 7 Years, at 6 *per Cent.* Compound Interest?

Principal 20*l.* Rate 1.06, Time 7 Years.



See the Work.

Log. of 1.06, the Rate is  
Multiply by the Time

0.0253059

Product of the Rate and Time,

Log. 0.1771413

Add the Log. of 20 the Principal

1.3010299

The Sum is

1.4781712

Which is the Log. of 30.7, or 30 l. 14 s. the Amount  
sought.

EXAMPLE II.

What will 365 l. 14 s. 6 d. amount to, forborn 17 Years  
and a Quarter, at 5 per Cent. Compound Interest?

Principal 365.775, Rate 1.05, Time 17.25

The Work.

Log. of 1.05, the Rate is

0.0211893

Multiply by the Time

1.425

Product of the Rate and Time,

Log. 0.2383796

Add the Log. of 365.775, the Principal

2.5632140

The Sum is

3.9885936

Which is the Log. 663 l. 6 s. the Amount.

R U L E. II.

Amount, Rate, and Time given, to find the Principal.

R U L E.

From the Logarithm of the Amount, subtract the Logarithm of the Rate, multiplied by the Time, the Remainder is the Logarithm of the Principal, or present Worth.

EXAMPLE I.

What present Money will pay a Debt of 20 l. due 7 Years hence, at 5 per Cent. per Ann. Compound Interest?

20 the Amount, 1.05 the Rate, and 7 the Time.

Log.

# Compound Interest

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Log. of 20 l. the Amount 1.3010300  
 Prod. of the Log. of the Rate and Time sub. 0.1488251  
 The Remainder is 1.1527049  
 Which is the Log. of 14 l. 4 s. 4 d.  $\frac{3}{4}$  the ready Money  
 sought.

## EXAMPLE II.

A Gentleman left his Son 150 l. to be paid at the Age  
 of 21 Years, of which 7 Years were spent at the said  
 time. The Executors desire to pay ready Money, so they  
 may have Rebate allow'd after the Rate of 6 per Cent. per  
 Ann. Compound Interest. The Question is, What ready  
 Money will pay this Debt?

Amount 150, Rate 1.06, Time 14 Years.  
 Log. of the Rate 1.06, is 0.0253059  
 Multiply by the Time 14 1012236  
 253059

## EXAMPLE II.

Product of the Rate and Time 3542826  
 Which sub. from the Log. of 150, viz. 2.1766913  
 Remainder 1.8218087  
 Which is the Log. of 66.345, or 66 l. 6 s. 11 d. which  
 is the Answer to the Question.

## PROP. III.

Principal, Amount, and Rate given, to find the Time.

## RULE.

From the Logarithm of the Amount subtract the Lo-  
 garithm of the Principal; that divided by the Logarithm  
 of the Rate gives the Time.

## EXAMPLE I.

In what Time will 20 l. amount to 40 l. at 6 per Cent.  
 per Ann. Compound Interest?

Prin-

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# Compound Interest.

Principal 20 l. Amount 40 l. Rate 1.06.  
 The Log. of 40 l. the Amount is 1.6020600  
 The Log. of 20 l. the Principal is 1.3010300  
 Diff. 3010300  
 .0253059 3010300 (11.895

253059

479710  
 253059  
 2266510  
 2024472  
 2420380  
 2277531  
 1428490

## EXAMPLE II.

In what Time will 15 s. amount to 15 l. at 10 per Cent. per Ann. Compound Interest?

Principal .75 Amount 15, Rate 1.10.  
 Log. of 15 the Amount is 1.176013  
 Log. of .75 the Principal is 9.8750612  
 Diff. 1.3010300

.0413927 1.3010300 (31.4313

1241781

592490  
 413927  
 1785630  
 1655708

1299220  
 181781  
 PROP.



## PROP. IV.

Principal, Time, and Amount given, to find the Rate.

## RULE.

From the Logarithm of the Amount, subtract the Logarithm of the Principal, the Remainder divided by the Time, quotes the Logarithm of the Rate.

## EXAMPLE I.

At what Rate of Compound Interest will 20*l.* amount to 30.072, or 30*l.* 1*s.* 5*d.* 1*q.* in 7 Years?

Principal 20*l.* Amount 30.072, Time 7 Years.

Amount 30.072, Log.

1.4781712

Principal 20*l.* Log.

1.3010300

$\frac{1}{7}$  0.1771412

$\frac{1}{7}$  0.0253058

Equal to the Logarithm of 1.06, the Rate sought.

## EXAMPLE II.

At what Rate of Compound Interest will 51*l.* 15*s.* amount to 76*l.* 18*s.* in 5 Years?

Principal 51.75, Amount 70.9, Time 5 Years.

Amount 70.9, Log.

1.8506462

Principal 51.75, Log.

1.7139103

0.1367359

$\frac{1}{5}$  0.0273471

Equal to the Logarithm of 1.065, which is 6*l.* 10*s.* per Cent. per Ann. the Rate sought.

The two first Propositions being often used, we have, as in *Simple Interest*, annexed Tables fitted thereto, at the Rate of 5 and 6 per Cent. and to continue for 31 Years.

T A-

| TABLE I. |                                                                                       |          | TABLE II.                                                                             |         |  |
|----------|---------------------------------------------------------------------------------------|----------|---------------------------------------------------------------------------------------|---------|--|
| Years.   | Shewing the Amount of one Pound for 31 Years, at 5 and 6 per Cent. Compound Interest. |          | Shewing the Rebate of one Pound for 31 Years, at 5 and 6 per Cent. Compound Interest. |         |  |
|          | 5                                                                                     | 6        | 5                                                                                     | 6       |  |
| 1        | 1.050000                                                                              | 1.060000 | .925381                                                                               | .943396 |  |
| 2        | 1.102500                                                                              | 1.123600 | .907030                                                                               | .889996 |  |
| 3        | 1.157625                                                                              | 1.191016 | .863838                                                                               | .839619 |  |
| 4        | 1.215506                                                                              | 1.262477 | .822703                                                                               | .792093 |  |
| 5        | 1.276281                                                                              | 1.338225 | .783526                                                                               | .747858 |  |
| 6        | 1.340096                                                                              | 1.418519 | .746215                                                                               | .704966 |  |
| 7        | 1.407100                                                                              | 1.503630 | .710683                                                                               | .665097 |  |
| 8        | 1.477455                                                                              | 1.593848 | .676839                                                                               | .627412 |  |
| 9        | 1.551328                                                                              | 1.689479 | .644609                                                                               | .591898 |  |
| 10       | 1.628895                                                                              | 1.790848 | .613913                                                                               | .558394 |  |
| 11       | 1.710339                                                                              | 1.898298 | .584679                                                                               | .526787 |  |
| 12       | 1.795856                                                                              | 2.012196 | .556837                                                                               | .496969 |  |
| 13       | 1.885649                                                                              | 2.132928 | .530321                                                                               | .468839 |  |
| 14       | 1.979938                                                                              | 2.260904 | .505068                                                                               | .442301 |  |
| 15       | 2.078928                                                                              | 2.396558 | .481017                                                                               | .417265 |  |
| 16       | 2.182874                                                                              | 2.540352 | .458117                                                                               | .393647 |  |
| 17       | 2.292018                                                                              | 2.692773 | .436296                                                                               | .371364 |  |
| 18       | 2.406619                                                                              | 2.854339 | .415520                                                                               | .350343 |  |
| 19       | 2.526950                                                                              | 3.025599 | .395734                                                                               | .330513 |  |
| 20       | 2.653298                                                                              | 3.207135 | .376889                                                                               | .311804 |  |
| 21       | 2.785962                                                                              | 3.399564 | .358942                                                                               | .294155 |  |
| 22       | 2.925261                                                                              | 3.603537 | .341849                                                                               | .277505 |  |
| 23       | 3.071524                                                                              | 3.819750 | .325571                                                                               | .261797 |  |
| 24       | 3.225100                                                                              | 4.048935 | .310067                                                                               | .246978 |  |
| 25       | 3.386355                                                                              | 4.291871 | .295302                                                                               | .232998 |  |
| 26       | 3.555673                                                                              | 4.549383 | .281240                                                                               | .219810 |  |
| 27       | 3.733456                                                                              | 4.822346 | .267848                                                                               | .207368 |  |
| 28       | 3.920129                                                                              | 5.111687 | .255093                                                                               | .195630 |  |
| 29       | 4.116135                                                                              | 5.418388 | .242946                                                                               | .184556 |  |
| 30       | 4.321942                                                                              | 5.743491 | .231377                                                                               | .174110 |  |
| 31       | 4.538099                                                                              | 6.088101 | .220359                                                                               | .164244 |  |

*The Construction and Uses of the foregoing Tables.*

For the Construction of these two Tables are several Methods used: We shall only mention that which is most easy and expeditious, which is by the Logarithms.

For the first Table thus: Seek by the first Proportion foregoing, the Amount of one Pound for 31 Years, and betwixt that Log. and the Log. of the Rate find 30 Geometrical mean Proportionals, as before taught, which shall be the Log. of the Number in the first Table; which is nothing else but the continual Addition of the Log. of the Rate to itself, and to its last Sum: As if we add the Log. of the Rate to itself, the Sum is the Log. of the Number belonging to the second Year, and to that Sum add again the Log. of the Rate, gives the Log. of the Number belonging to the third Year; and thus you may do till you have finished: Or if you multiply the Log. of the Rate by 1, 2, 3, 4, 5, 6, &c. gives the Log. of the Numbers answering those respective Years.

And for the Numbers in the second Table, take the Arithmetical Complements of the Log. of the Numbers in the first Table, and you will have the Log. of the Numbers in the Second.

*Now for their Uses.*

These Tables are to be used in the same Manner as those in *Simple Interest*, and so need but few Examples.

Take an Example for the Use of the first Table.

What will 20 *l.* amount to forborn 7 Years at 6 *per Cent.* Compound Interest?

In the first Table under 6 *per Cent.* and over-against 7 Years is

Which multiplied by

The Product is

Which is equal to 30 *l.* 1 *s.* 5 *d.* 1 *q.*

Take another Example for the Use of the second Table.

What ready Money will pay a Debt of 36 *l.* 10 *s.* due 21 Years hence, at 5 *per Cent.* Compound Interest?

X x

The



*The Operation.*

In the second Table, and under 5 per Cent. and over-  
against 21 Years is  $358942$

Which multiplied by  $36.5$

---

 $1794710$ 
 $2153652$ 


---

 $1076826$ 

Produceth  $13.1013830$

which is equal to 13 l. 2 s. and  $\frac{1}{4}$  d. The Answer.

## SECTION II.

In the Solution of the Questions of *Compound Interest* concerning Annuities in arrear, we may consider it under these four Particulars (*viz.*)

*First*, The Annuity or Pension.

*Secondly*, The Time of Forbearance in Years, or Parts of a Year.

*Thirdly*, The Rate of Interest. And,

*Fourthly*, The Amount of the said Annuity, for the said Rate and Time.

Any three of these being given, to find the Fourth, as in these four *Propositions* following.

## PROP. I.

Annuity, Rate and Time given, to find the Amount.

## RULE.

First you find a correspondent Principal in this manner; As the Interest: To its Principal :: So the given Annuity: To its correspondent Principal. Next multiply the Logarithm of the Rate by the Time, to which add the Logarithm of the correspondent Principal, the Sum is the Logarithm of a Number; from which subtract the correspondent Principal, leaves the Amount.

# Compound Interest.

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## EXAMPLE.

An Annuity of 20 l. per Annum is forborn 7 Years;  
What will then be due at 6 per Cent. Compound Interest?

First say, If 6 : 100 :: 20

552210.1 — 200000.0

100000.1 — 200000.0

780000.1 — 200000.0

680000.1 — 200000.0

333  $\frac{1}{3}$  = the Correspondent Principal.

Log. of the Rate

Multiplied by the Time

0.0253059

7

Log. of the Rate  $\times$  by Time

0.1771413

Log. of 333  $\frac{1}{3}$  the corresp. Principal add

2.5228788

Equal to the Log. of 501.210

2.7000201

Cor. Princ. subtract 333.333

Rem 167.877 = to 167 : 17 : 6  $\frac{1}{2}$  per  
the Answer.

## EXAMPLE II.

There is an Annuity of 50 l. per Annum, payable by

quarterly Payments, viz. 12.5 per Quarter; this Annuity is forborn to the End of 11 Years and a half; the Question is, What will then be due at 6 per Cent. Compound Interest?

Note, If the Interval betwixt any Payments be less than a Year, as suppose half-yearly, quarterly, monthly, weekly, daily, &c. then you must divide the Logarithm of the Rate by such Parts; as by 2 for half-yearly Payments, 4 for quarterly Payments, by 52 for weekly Payments, and by 365 for daily Payments; and your Quotient will be a proportional Rate, whereby to find your correspondent Principal: For if the absolute Number answering that Quotient, be made less by an Unit, it will be a new Divisor; by which dividing your half-yearly, quarterly, &c. Payments; your Quotient will be a correspondent Principal; then may you work as before.

X x 2

See

## Compound Interest.

See underneath the Logarithm of 1.05 and 1.06, so divide with their natural Numbers placed over-against them.

Logarithms. Natural Numb.

|                |                       |
|----------------|-----------------------|
| Log. of 1.05   | 0.0211893 = 1.05      |
| $\frac{1}{2}$  | 0.0105946 = 1.0246738 |
| $\frac{1}{4}$  | 0.0052973 = 1.0122722 |
| $\frac{1}{8}$  | 0.0017658 = 1.0040741 |
| $\frac{1}{16}$ | 0.0004075 = 1.0009387 |
| $\frac{1}{32}$ | 0.0000581 = 1.0001336 |
| $\frac{1}{64}$ |                       |
| Log. of 1.06   | 0.0253058 = 1.06      |
| $\frac{1}{2}$  | 0.0126529 = 1.0295696 |
| $\frac{1}{4}$  | 0.0063264 = 1.0146738 |
| $\frac{1}{8}$  | 0.0021088 = 1.0048673 |
| $\frac{1}{16}$ | 0.0004866 = 1.0011019 |
| $\frac{1}{32}$ | 0.0000693 = 1.0001596 |
| $\frac{1}{64}$ |                       |

So in the last Question the Payments being quarterly, I take the natural Number answering  $\frac{1}{4}$  Part of the Logarithm of the Rate 1.06, which made less by Unity, is .014673; by which dividing the quarterly Payment, 12 / 10 s. quotes 851.9048, the Correspondent Principal.

See the Work.

$$.014673) 12.5000000 (851.9048$$

117384

76160

73365

27950

14673

132770

132957

71300

58692

12608

Log.



# Compound Interest.

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Log. of the Rate  $1.06$  is:  $0.0253058$   
Multiply by the Term  $11.5$

$1265290$   
 $253058$   
 $253058$

Log. of the Rate and Time  $.29101670$   
Log. of the Corresp. Principal, add  $2.93039110$

The Sum is the Log. of  $1665.2053$   $= 3.22140780$   
Sub. the Cor. Principal,  $851.9048$

Rest of the Principal  $813.3005$   $= 10.8131.617$   
which is the Answer.  
**PROPOSITION II.**  
Amount, Rate and Time given, to find the Annuity.

## RULE.

Suppose an Annuity at Pleasure, and by the last Proposition find the Amount or Arrearages; then you may say;  
As the Amount: To the supposed Annuity:: So the Amount given: To the Annuity required.

## EXAMPLE.

What Annuity at  $6\%$  Compound Interest, will raise a Stock of  $167.8773$  in  $7$  Years?

Suppose  $3\%$ .

Then if  $6:100::3:$  Facit  $50\%$  a Corresp. Principal.

Log. of the Rate  $0.0253059$   
Multiply by the Time  $7$

Log. of the Correspond. Principal, add  $0.1771413$   
 $1.6989700$

Equal to the Log. of  $75.181$   $1.8761113$   
Cor. Princip. subtr.  $50.000$

$25.181$

Then

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*Compound Interest.*

Then say, If 25.181 : 3 :: 167.877

25.181) 503.631 (20 l.  
50362

II

**PROP. III.**

Annuity, Rate and Amount given, to find the Time.

**RULE.**

Find a correspondent Principal, add to it the given Amount, and from the Logarithm of that Sum, subtract the Logarithm of the Correspondent Principal, the Remainder, divided by the Logarithm of the Rate, quotes the Time.

**EXAMPLE.**

In what Time will 20 l. per Annum raise a Stock of 167.877, Compound Interest being computed at 6 per Cent. per Annum.

First, If 6 : 100 :: 20 : Facit 333 : Corresp. Principal.

Given Stock 167.877

Corresp. Princ 333.333

The Sum 501.210

Log. of 501.21 is

2.7000197

Log. of the Corresp. Principal is

2.5228783

.0253059) 1771412 (7

1771413

Answer in 7 Years.

**PROP. IV.**

The Annuity, Amount and Time given, to find the Rate of Interest.

**RULE.**

## R U L E.

To answer this, we will use Approximation, it being the most concise and quickest Method we can use. Wherefore make two or three Trials, 'till you get the Answer bounded betwixt two of the nearest Results; then the Work may be performed by Proportion, as may be seen in the Work of the following Example.

## E X A M P L E.

An Annuity of 20 *l.* per Annum for 7 Years is offered to

be let for 180.5, or 180 *l.* 10 *s.* to be paid at the End of the said Term; what Interest is allowed in this Bargain?

Interest of Money being seldom above 10 *l.* and under 5 per Cent. Wherefore I make a Supposition at 8 per Cent. and by the first Proposition I find the Amount at that Rate,

to be 178.456, which is too little by 2.044.

Wherefore, because I see I am near, I make my second Trial at 8 *l.* 10 *s.* per Cent. and working as before, I find the Amount to be 181.21, whereby I see I have overshoot the Truth by .71, and I see the Answer is bounded betwixt 8 *l.* per Cent. and 8 *l.* 10 *s.* per Cent.

Wherefore, as in the Rule of False, by these two Suppositions, and their respective Errors, I find the Rate as under.

First Supposition 8 the Error 2.044—

Second Supposit. 8.5 the Error 0.71 +

Supp. Difference .5 Sum 2.754

Then say, As 2.754 : .5 :: 2.044 : .371, which added to the first Supposition 8, gives 8.371, or 8 *l.* 7 *s.* 5 *d.* the Rate of Interest sought.

The first Proposition being of good and frequent Use, we have adjoined a Table fitted thereto, and calculated at the Rate of 5 and 6 per Cent. Compound Interest, and to continue for 31 Years.



The Construction and Use thereof, here follow.

*Its Construction.*

The Logarithmical Differences of .05 or .06 (being the Rates here used minus Unity) and the Numbers in the Table shewing the Amount of one Pound at 5 and 6 per Cent. for 31 Years minus Unity, are the Logarithms of the Numbers in this Table.

Take an Example or two for the Use.

What will an Annuity of 3*l.* 15*s.* 6*d.* amount to, forborn 21 Years, Compound Interest, being computed at 6 per Cent.

Tabular Number answering 21 Years, and under 6 per Cent. is 39.992727

Multiply by 3.775

199963635

279949089

279949089

119978181

150.972544425

Facit 150*l.* 19*s.* 5*d.*  $\frac{1}{2}$

A TABLE, shewing the Amount of one Pound Annuity forborn for 31 Years, or under, at 5 and 6 per Cent. Compound Interest.

| Years. | 5         | 6         |
|--------|-----------|-----------|
| 1      | 1.000000  | 1.000000  |
| 2      | 2.050000  | 2.060000  |
| 3      | 3.152500  | 3.183600  |
| 4      | 4.310125  | 4.374616  |
| 5      | 5.525631  | 5.637093  |
| 6      | 6.801913  | 6.975318  |
| 7      | 8.142008  | 8.393837  |
| 8      | 9.549108  | 9.897467  |
| 9      | 11.026564 | 11.491316 |
| 10     | 12.577892 | 13.180795 |
| 11     | 14.206787 | 14.971943 |
| 12     | 15.917126 | 16.869940 |
| 13     | 17.712982 | 18.882137 |
| 14     | 19.598631 | 21.015063 |
| 15     | 21.578568 | 23.275969 |
| 16     | 23.657491 | 25.672527 |
| 17     | 25.840366 | 28.212879 |
| 18     | 28.132384 | 30.905651 |
| 19     | 30.539003 | 33.759992 |
| 20     | 33.065954 | 36.785590 |
| 21     | 35.719251 | 39.992727 |
| 22     | 38.505214 | 43.392291 |
| 23     | 41.430475 | 46.995816 |
| 24     | 44.501999 | 50.815575 |
| 25     | 47.727099 | 54.864510 |
| 26     | 51.113453 | 59.156381 |
| 27     | 54.669126 | 63.705763 |
| 28     | 58.402583 | 68.528112 |
| 29     | 62.322712 | 74.639799 |
| 30     | 66.438847 | 79.058184 |
| 31     | 70.760790 | 84.801677 |

## EXAMPLE II.

What will an Annuity of 50 *l.* per Annum amount to, forborn 7 Years, at 5 per Cent. Compound Interest?

Tabular Number under 5 per Cent. and against 7 Years is 8.142008

Multiplied by 50

Answer, 407 *l.* 2 *s.* 407.100400

In the Solutions of Questions of Compound Interest, relating to many equal Payments, at many equal Times, as in the buying or purchasing Annuities, Pensions, or Leases in Reversion, we may consider it under these four Particulars:

First, The Annuity, or Pension to be sold.

Secondly. The Time of Continuance, either considered as yearly, half-yearly, or quarterly Payments.

Thirdly, The Rate of Interest. And,

Fourthly, The present Worth of the Whole, paid at one entire Payment, or equally reduced to such.

Any three of these being given, to find the fourth, as in the four Propositions following.

## PROP. I.

Annuity, Rate, and Time given, to find the present Worth.

## RULE.

Find a Correspondent Principal, as before taught; then multiply the Logarithm of the Rate by the Time, which subtract from the Correspondent Principal, the Remainder is the Logarithmical Difference of the Principal and Worth, and so by Consequence the Worth is given.

## EXAMPLE.

There is an Annuity of 20 *l.* per Annum, payable by yearly Payments, and to continue 7 Years, to be sold for ready Money: What is it worth, Compound Interest being allowed the Purchaser at 5 per Cent.?

Y y

See

*See the Work.*If 5*l.* : 100 *l.* :: 20 *l.* : Facit 400 *l.* Corresp. Princip.

Log. of 1.05 the Rate is 0.0211893

Multiply by

— Log. of the Rate and Time

0.1483251

Log. of 400 the Corresp. Princip.

2.6020600

The Difference is 2.4537349  
 Equal to the Logarithm of 284.2725; which subtracted  
 from 400 *l.* leaves 115 *l.* 14*s.* 6*d.*  $\frac{1}{2}$ , the present Worth  
 sought.

**EXAMPLE II.**

An annual Rent of 365 *l.* paid yearly, and to continue  
 12 Years, is to be sold for present Money; what is it  
 worth at 5 per Cent. Compound Interest?

*See the Work.*If 5 *l.* : 100 *l.* :: 365 : Facit 7300 Corresp. Princip.

Log. of 1.05 the Rate is

0.0211893

Multiply by the Time

12

0.423786

2.11893

Logarithm of the Rate and Time

2.542716

Log. of 7300 the Corresp. Princip.

3.8633228

The Difference is 3.6090512  
 which is the Logarithm of 4064.913, or 4064 *l.* 18*s.* 3*d.*  
 which subtracted from 7300 *l.* leaves 3235 *l.* 1*s.* 9*d.* the  
 Worth sought.

**EX**



## EXAMPLE III.

But if the aforementioned Annuity were to be paid by quarterly Payments, viz. 91  $\text{ls}$  5  $\text{s}$  per Quarter, what would be the present Worth, allowing the same Rate of Interest as before.

Proportional Interest for quarterly Payments at 5 per Cent. is  $\equiv$  to 1.0122722—1  $\equiv$  0.0122722; by which dividing the quarterly Rent, quotes the Correspondent Principal.

0.0122722 91.2500 7435.5046 Corresp. Principal.

Log. of the Rate 1.05, is

0.0211893

Multiply by the Time

12

423786

211893

Log. of the Rate and Time

2542716

Log. of 7435.5046, the Cor. Principal

3.8713104

The Difference is

3.6170388

which is the Logarithm of 4146.4671; which subtracted from 7435.5046, leaves 3295.0375, equal to 3295  $\text{ls}$  and 9  $\text{d}$ . the present Worth; by which you may perceive that quarterly Payments in this Annuity, raise the Value 59  $\text{l}$ . 19  $\text{s}$ .

Notwithstanding, in the purchasing of Annuities, very few Persons will value a Lease the more for being paid quarterly.

## EXAMPLE IV.

But if the said Annuity were to be paid by daily Payments, viz. 20  $\text{s}$ . per Day, what would be the present Worth, keeping the same Rate of Interest still?

Proportional Interest for daily Payments is .0001336, when Unity is subtracted; by which dividing the daily Rent, quotes the Correspondent Principal.

Y y 2

.0001.

.0001336) 1.000(7485.03 Cor. Principal.

Log. of 7485.03, is

3.8741935

Log. of the Rate and Time, is

0.2542716

The Difference is 3.6199219  
which is the Logarithm of 4067.9246; which subtracted  
from 7485.03, will leave 3317.0854, equal to 3317 l.  
1 s. 8 d.  $\frac{1}{2}$ . So the Difference of the present Worth of  
this Annuity, according to yearly and daily Payments,  
is 82 l. 1 s. 8 d.

### EXAMPLE V.

An Annuity of 24 l. per Ann. to begin after the End  
of 6 Years, whereby the first Rent will not be received  
till after the Expiration of 7 Years, and to continue 21  
Years, is to be sold for present Money; what is it worth  
on this Condition, allowing the Purchaser 6 per Cent.  
Compound Interest?

If this Annuity were to begin presently, the Worth by  
this Proposition would be found to be 382.3378, or 382 l.  
6 s. 9 d.

But seeing it begins not till the End of 6 Years, you  
must by the second Proposition of the first Section of this  
Chapter, find what ready Money would pay a Debt of  
382.3378, due 6 Years hence; which will appear to be  
269.5328, or 269 l. 10 s. 8 d. which is the present Worth  
of this Annuity according to the Condition aforesaid.

### PROP. II.

Present Worth, Rate and Time given to find the  
Annuity.

### RULE.

Suppose an Annuity at Pleasure, and had the Worth by  
the last; then the Proposition runs,

As the Worth found: To the supposed Annuity ::

So the Worth given: To the Annuity required.

E X.

## EXAMPLE.

What Annuity, to continue 78 Years, will be purchased for 120 *l.* at 5 per Cent. Compound Interest? Suppose 15 *l.* and by the last Proposition, the present Worth will be found to be 83.7357.

Then say, If 83.7357 : 15 :: 120 : Facit 21.4962, or 21 *l.* 9 *s.* 11 *d.* 1 *q.* the Answer. And thus of any other.

## PROP. III.

Annuity, present Worth, and Rate of Interest given, to find the Time of Continuance.

## RULE.

Find a Correspondent Principal, subtract the Debt out of the Correspondent Principal; and the Logarithm of their Difference out of the Logarithm of the Correspondent Principal; this last Difference divided by the Logarithm of the Rate, shows the Time.

## EXAMPLE I.

In what Time will 20 *l.* per Ann. pay a Debt of 115.7275, or 115 *l.* 14 *s.* 6 *d.*  $\frac{1}{4}$  at 5 per Cent. Compound Interest?

First, If 5 : 100 :: 20 : Facit 400 Cor. Prin.

|                     |          |
|---------------------|----------|
| From the Cor. Prin. | 400      |
| Subtract the Debt.  | 115.7275 |

|                   |          |
|-------------------|----------|
| The Difference is | 284.2725 |
|-------------------|----------|

|                                         |           |
|-----------------------------------------|-----------|
| Log. of the Cor. Prin. 400 <i>l.</i> is | 2.6020600 |
|-----------------------------------------|-----------|

|                      |           |
|----------------------|-----------|
| Log. of 284.2725, is | 2.4537349 |
|----------------------|-----------|

|             |
|-------------|
| 1483251 (7) |
| 1483251     |

Answer, in 7 Years.



## EXAMPLE II.

*A* borrows of *B* 1728 *l.* and at the same time delivers up to *B* an Annuity of the clear Value of 240 *l.* per Ann. which he is to enjoy till he be fully satisfied for his 1728 *l.* The Question is, How long *B* must enjoy the Premises, Compound Interest being computed at 6 per Cent. per Ann.

First, I say, If 6 : 100 :: 240 : Facit 4000 Cor. Prin.  
From the Cor. Principal 4000  
Subtract the Debt 1728

The Difference is 2272  
Log. of 4000, the Cor. Principal, is 3.6020600  
Log. of the said Difference 2272, is 3.3564083

The Difference is 2456517  
which divide by the Log. of 1.06  
= .0253059) 2456517 (9.70729  
2277531

1789800  
1771413

1844700  
1771413  
732879  
506118

226752  
Answer In 9 Years, 9 Months, 0 Weeks, and 5 Days:  
And so long *B* must enjoy the Premises.

## EXAMPLE III.

*A* lends to *B* 600 *l.* and *B* is willing to pay a quarterly Rent of 15 *l.* per Quarter till *A* be satisfied for his 600 *l.* How many Quarters Rents must *B* receive, Compound Interest

# Compound Interest.

353

Interest being computed at 5 per Cent. And what will the last Payment be? Divide 15 by the natural Number to 1 of the Log. of the Rate less 1.

1222.2722) 15.0000000 (1222.2747 Cor. Prin.

From the Cor. Principal 1222.2747

Subtract the Debt 600

The Difference is 622.2747

Log. of the Cor. Prin. 1222.2747, is 3.0871688

Log. of the Difference 622.2747, is 2.7939821

Their Difference is .2931867

1 Log. Rate

= .0052973) .2931867 (55.3464—to 55 whole Quarters, and something above 1 of a Quarter. Answer, He must receive 55 Quarters Rent; and the last Payment will be 56.3.

## P R O P. IV.

The Annuity, present Worth, and Time of Continuance given, to find the Rate of Interest.

This Proposition is best performed by Approximation; for by two or three Trials (but they must be near the Truth) you will have the Answer bounded betwixt two Numbers; as in the last Proposition of the last Section.

An Annuity of 20 l. per Ann. to continue for 7 Years, is sold for 100 l. ready Money; What Rate of Compound Interest hath the Purchaser for the Money?

Interest of Money being seldom above 10, or under 5 per Cent. I make my first Supposition at 9 per Cent. and, by the first Proposition of this Section, the present Worth of 20 l. per Ann. to continue 7 Years, will be found to be 100.659056, which should have been 100 l. wherefore the Error is .659056. And seeing the Supposition was short, I place it and the Error as here,

$$\begin{array}{r} 9 + .659056 \\ 9.25 - .18 \end{array}$$

But

But seeing I am pretty near, I make my next Supposition at 9 *l.* 5 *s.* and by the same Proposition, the said Annuity for the same Time will be worth 99.82, which should have been 100; by which I see I have proposed too much, and the Error is .18; which Supposition and Error I place under the other, and say,

As .839, the Sum of the Errors: To .25, the Difference of Suppositions: So .18, the latter Error: To .536; which subtract from the latter Supposition, because it was too great, leaves 9.1964, or 9 *l.* 3 *s.* 11 *d.* the Rate sought.

And though this be mathematically true and demonstrable; and that by delivering up of an Annuity of 20 *l.* per Ann. to continue for 7 Years, for 100 *l.* paid in Hand, he allows 9 *l.* 3 *s.* 11 *d.* per Cent. per Ann. yet he will never be able to make that Interest by his Annuity, unless he can find such a Fool as will take his annual Payments as they become due, and give him 9 *l.* 3 *s.* 11 *d.* per Cent. Compound Interest; which will be hard to do, when any responsible Man may be fitted for 6, nay in most Places for 5 per Cent.

Wherefore Mr. Martindale was in the right, according to the Intent and Import of his Propositions; and that he can but make 7 *l.* 13 *s.* 7 *d.*  $\frac{1}{2}$ , supposing every Payment be taken off his Hand at 6 per Cent. Compound Interest; and this will be something difficult to do. And if some of his annual Rents, or all of them should not be improved, which is no impossible thing, he will not be able to make 6 per Cent. by his Annuity; so that I had rather put forth my Hundred Pound at 6 per Cent. Compound Interest for 7 Years, than stand to the Venture of the Improvement of the Annuity.

The two first Propositions being of good Use, we have annexed Tables fitted thereto for 31 Years, at 5 and 6 per Cent. Compound Interest.



| TABLE I.                                                                                                     |           |           | TABLE II.                                                                                                   |          |  |
|--------------------------------------------------------------------------------------------------------------|-----------|-----------|-------------------------------------------------------------------------------------------------------------|----------|--|
| Shewing the present Worth of one Pound Annuity, to continue for 31 Years, at 5 and 6 per Cent. Compound Int. |           |           | Shewing what Annuity, to continue 31 Years, one Pound will purchase at 5 and 6 per Cent. Compound Interest. |          |  |
|                                                                                                              | 5         | 6         | 5                                                                                                           | 6        |  |
| 1                                                                                                            | 0.952381  | 0.943396  | 1.050000                                                                                                    | 1.060000 |  |
| 2                                                                                                            | 1.859410  | 1.833392  | .537805                                                                                                     | .545437  |  |
| 3                                                                                                            | 2.723248  | 2.673012  | .367208                                                                                                     | .374110  |  |
| 4                                                                                                            | 3.545950  | 3.465105  | .282012                                                                                                     | .288591  |  |
| 5                                                                                                            | 4.329477  | 4.212363  | .230952                                                                                                     | .237396  |  |
| 6                                                                                                            | 5.075692  | 4.917324  | .197017                                                                                                     | .203369  |  |
| 7                                                                                                            | 5.786373  | 5.582381  | .172820                                                                                                     | .179135  |  |
| 8                                                                                                            | 6.463212  | 6.209792  | .154722                                                                                                     | .161036  |  |
| 9                                                                                                            | 7.107821  | 6.801691  | .140690                                                                                                     | .147022  |  |
| 10                                                                                                           | 7.721734  | 7.360086  | .129505                                                                                                     | .135868  |  |
| 11                                                                                                           | 8.306414  | 7.688873  | .120389                                                                                                     | .126793  |  |
| 12                                                                                                           | 8.863251  | 8.383843  | .112825                                                                                                     | .119272  |  |
| 13                                                                                                           | 9.393572  | 8.852682  | .106456                                                                                                     | .112960  |  |
| 14                                                                                                           | 9.898640  | 9.294983  | .101023                                                                                                     | .107585  |  |
| 15                                                                                                           | 10.379658 | 9.712248  | .096342                                                                                                     | .102963  |  |
| 16                                                                                                           | 10.837769 | 10.105894 | .092270                                                                                                     | .098952  |  |
| 17                                                                                                           | 11.274065 | 10.477258 | .088699                                                                                                     | .095445  |  |
| 18                                                                                                           | 11.689586 | 10.827602 | .085546                                                                                                     | .092356  |  |
| 19                                                                                                           | 12.085320 | 11.158115 | .082745                                                                                                     | .089621  |  |
| 20                                                                                                           | 12.462209 | 11.469920 | .080242                                                                                                     | .087184  |  |
| 21                                                                                                           | 12.821152 | 11.764075 | .077996                                                                                                     | .085004  |  |
| 22                                                                                                           | 13.163092 | 12.041580 | .075970                                                                                                     | .083045  |  |
| 23                                                                                                           | 13.488573 | 12.303377 | .074137                                                                                                     | .081278  |  |
| 24                                                                                                           | 13.798641 | 12.550356 | .072441                                                                                                     | .079679  |  |
| 25                                                                                                           | 14.093944 | 12.783354 | .070952                                                                                                     | .078227  |  |
| 26                                                                                                           | 14.375184 | 13.003164 | .069564                                                                                                     | .076904  |  |
| 27                                                                                                           | 14.643033 | 13.210431 | .068292                                                                                                     | .075697  |  |
| 28                                                                                                           | 14.898127 | 13.406162 | .067122                                                                                                     | .074592  |  |
| 29                                                                                                           | 15.141073 | 13.590721 | .066045                                                                                                     | .073579  |  |
| 30                                                                                                           | 15.372450 | 13.764829 | .065051                                                                                                     | .072649  |  |
| 31                                                                                                           | 15.592810 | 13.929084 | .064132                                                                                                     | .071792  |  |

*The Construction of the foregoing TABLES.*

If from the Logarithms of the Numbers in that Table under Section the Second, you subtract the Logarithms of the Numbers in Table the First, Section the First, the Remainders are the Logarithms of the Numbers in the first Table here.

And their Complements Arithmetical are the Logarithms of the Numbers in the Second Table.

*Their USE.*

There is no Difference betwixt the Use of these Tables and those going before, as may be seen in the following Examples.

*Examples in the Use of the First TABLE.*

I. An Annuity of 20 *l.* per Ann. clear Value, is to be sold for 7 Years: What ready Money is it worth, at 5 per Cent. Compound Interest?

Multiply the Tabular Number under 5 per Cent. and over-against 7 Years, viz. 5.786373

By 20, the given Annuity 20

115.727460

Gives the Answer, viz. 115 *l.* 14 *s.* 6 *d.*  $\frac{1}{4}$ .

*E X A M P L E.*

There is a Lease of Lands worth 32 *l.* per Ann. more than the Rent paid to the Lord; of which Land there is yet a Lease in being for 7 Years; and the Lessee is desirous to take a Lease in Reversion for 21 Years, to begin when his old Lease is expired. What Sum of Money is to be paid for his Lease, allowing Interest at the Rate of 6 per Cent. per Annum.

First, See what this Rent of 32 *l.* is worth for 7 Years, which will be 178 *l.* 12 *s.* 9 *d.* *ferè.*

Secondly, Add 7 Years to 21 Years, which makes 28 Years, then see what 32 *l.* to continue 28 Years, is worth, which will be 428 *l.* 19 *s.* 11 *d.*  $\frac{1}{4}$ .

Lastly,

# Compound Interest.

2357

Lastly, Subtract the present Worth for 7 Years from the present Worth for 28 Years, the Difference is the Answer to the Question, to wit, 250 l. 7 s. 2 d. 2.

The Work for 7 Years. The Work for 28 Years.

$$\begin{array}{r} 5:582381 \\ 33 \\ \hline 11164762 \\ 16747143 \\ \hline 178.636192 \end{array} \quad \begin{array}{r} 13.406162 \\ 32 \\ \hline 26812324 \\ 40218486 \\ \hline 428.997184 \end{array}$$

$$\begin{array}{r} 178.636192 \\ \text{From } 428.997184 \\ \hline \text{Sub. } 178.636192 \end{array}$$

From 428.997184

Sub. 178.636192

Sub. 250.360992 The Answer.

## Examples in the Use of the Second TABLE.

I. What Annuity, to continue 9 Years, will 34 l. purchase, Compound Interest being computed at 5 per Cent.?

Tabular Number in Table the Second, under 5 per Cent. and over-against 9 Years, is .140690

Multiply by 34

$$\begin{array}{r} 562760 \\ 422670 \\ \hline \end{array}$$

Answer, 4 l. 15 s. 8 d. Facit 4.783460

## EXAMPLE II

What Annuity, to continue 21 Years, will 365 l. purchase, Compound Interest being computed at 6 per Cent. per Ann.?

Tabular Number in Table the Second, under 6 per Cent. and over-against 21 Years, is .085004

Multiply by 365

$$\begin{array}{r} 425020 \\ 510024 \\ 255012 \\ \hline \end{array}$$

Answer, 31 l. 0 s. 6 d.

31.026460



## S E C T. IV.

Now, in the last Place, we shall treat of Compound Interest, as it relates to the purchasing of Freehold Estates, to be bought or sold for ever.

This by several is called Compound Interest infinite, because it relates to diverse equal Parts at diverse equal Times; but the Number of those equal Times are infinite; As in purchasing an Estate in Fee-Simple for ever.

And this may be considered under these three Particulars.

*First*, The Annuity paid by yearly or quarterly Payments.

*Secondly*, The Price, or present Worth.

*Thirdly*, The Rate of Interest.

Any two of these being given, to find the Third; as in the three Propositions following.

## P R O P. I.

The Annuity and Rate of Interest given, to find the present Worth.

## R U L E.

The annual (half-yearly, or quarterly) Payment divided by the Rate of Interest, *minus* Unity, quotes the present Worth.

## E X A M P L E.

There is an Estate to be sold of the clear Value of 20 *l.* *per Ann.* what Sum of ready Money is this Estate worth, Compound Interest being allowed the Purchaser at 6 *per Cent.*

$$.06) 20.000 (333.333 = 333 \text{ l. } 6 \text{ s. } 8 \text{ d.}$$

$$\begin{array}{r}
 18 \\
 \hline
 20 \\
 18 \\
 \hline
 20 \\
 18 \\
 \hline
 20 \\
 18 \\
 \hline
 20 \\
 18 \\
 \hline
 2
 \end{array}$$

*Ans.* 333 *l.* 6 *s.* 8 *d.*

E X.

# Compound Interest.

359

## EXAMPLE II.

But if the said Annuity were paid by quarterly Payments, viz. 5% per Quarter; what would be the present Worth, holding still the same Rate of Interest?

Quarterly Rate,  
minus Unity, is .014674) 5.000000 {340.7387

44022

Ans. 340*l.* 14*s.* 9*d.*

59780

58696

Quarterly Payment raised  
the Worth 7*l.* 8*s.* 1*d.*

108400

102718

5682

## PROP. II.

Present Worth, or Purchase Money, together with the Rate of Interest being given, to find the Annuity.

### R U L E.

Multiply the Purchase Money by the Rate of Interest, minus Unity, the Product shall be the annual Rent.

## EXAMPLE.

A Gentleman hath a Desire to lay out 333*l.*  $\frac{1}{2}$  on a Freehold Estate, provided he meets with a Bargain as shall bring him in 6 per Cent. Compound Interest for his Money: What annual Rent must this be?

333.333

.06

19.99999

Facit, 20*l.*

## PROP. III.

The Annuity and present Worth given, to find the Rate of Interest.

### R U L E.

The annual Rent divided by the present Worth, or Sum demanded, quotes the Rate, minus Unity.

## EXAMPLE.

There is an Estate to be sold of the yearly Value of 20 *l.* for 333 *l.*  $\frac{1}{3}$ , what Rate of Compound Interest will the Purchaser have for his Money.

$$\begin{array}{r} 333.333) 20.000000 (.06 \\ \underline{19999999} \end{array}$$

Answ. 6 per Cent.

## EXAMPLE II.

There is a Freehold Estate to be sold for 1600 *l.* the yearly Rent being 128 *l.* what Rate of Compound Interest shall the Purchaser have for his Money?

$$\begin{array}{r} 1600) 128.000 (.08 \\ \underline{128000} \end{array}$$

Answ. 8 per Cent.

Lastly, If it be required how many Years Purchase any Annuity is worth, work thus; divide Unity by the Rate, minus Unity, the Quote exhibits the Number of Years.

## EXAMPLE III.

There is a Freehold Estate to be sold, how many Years Purchase is it worth at 5 per Cent. per Ann. Compound Interest?

$$.05) 1.00 (20$$

10

Answ. 20 Years Purchase.

00

What is it worth at 6 per Cent.?

$$.06) 1.0 (16.666$$

6

40

36

Answ. 16 Years and  $\frac{2}{3}$ .

4, &c.

Likewise, if an Estate be offered at any Number of Years Purchase, and the Rate of Interest be demanded, do thus; divide Unity by the Number of Years proposed, and the Quote gives the Rate, minus Unity.

EX-



## EXAMPLE IV.

An Estate is offered at 20 Years Purchase: What is the Rate of Interest?

$$\begin{array}{r} 20) 1.00 \quad (.05 \\ 1.00 \end{array}$$

Ans. 5 per Cent.

## VI. T 2 3 U 2

Here follow diverse Questions of Interest to exercise the Learner, both Simple and Compound; and so we will conclude *Logarithmical Arithmetick*.

## QUEST. I.

A owes B 800 *l.* to be paid in 4 Years, that is, at the End of every two Years 400 *l.* B owes A 900 *l.* to be paid in 6 Years, that is at the End of every two Years 300 *l.* They agree to clear their Debts, and allow each other 8 per Cent. Compound Interest: Which must pay Money, and how much?

Ans. B must pay unto A, 29 *l.* 16 *s.* 3 *d.* 1 *q.*

## QUEST. II.

A owes B 455 *l.* to be paid in 14 Years; that is at the End of every two Years 65 *l.* He would agree with his Creditor to pay him in 7 Years, viz. each Year one equal Payment, which B agrees to; and they conclude Compound Interest shall be allowed at 6 per Cent. What will this equal Payment be? Ans. 52 *l.* 10 *s.* 8 *d.*

Found by seeking the present Worth of the 7 Payments, paid each two Years, which will be 293 *l.* 5 *s.* 2 *d.* Then seek what Annuity, to continue 7 Years, 293 *l.* 5 *s.* 2 *d.* will purchase; which will be found to be 52 *l.* 10 *s.* 8 *d.* The Answer sought.

## QUEST. III.

A Merchant hath owing to him 10000 *l.* to be paid in five Years, viz. at the End of every Year 2000 *l.* and agrees with his Debtor, that if he will pay him 5000 *l.* Ready Money, he will take the Remainder in 21 Years by an equal annual Payment, Compound Interest being computed at 6 per Cent. to which his Debtor assents: The Question is, what will this equal annual Payment be?

*l.*

Ans. 291.11725, or 291 *l.* 2 *s.* 4 *d.*

Found

Found by seeking the present Worth of 2000*l.* per Ann. to continue 5 Years, which will be 8424*l.* 14*s.* 6*d.*  $\frac{1}{2}$ , from which subtracting 5000, rest 3424*l.* 14*s.* 6*d.*  $\frac{1}{2}$ . Then find what Annuity to continue 21 Years, 3424*l.* 14*s.* 6*d.*  $\frac{1}{2}$ . will purchase, viz. 201*l.* 2*s.* 4*d.* and that is the Answer.

## QUEST. IV.

There is an Annuity of 64*l.* 10*s.* to continue 120 Years, to be sold for ready Money; whether it is better to purchase this Annuity at 6 per Cent. Simple Interest, or at 6 per Cent. Compound Interest; likewise what is the Difference; and lastly, what is its Value taken as a Freehold Estate?

The Work according to Simple Interest.

|                                              |       |            |
|----------------------------------------------|-------|------------|
| 120                                          | 120   | 120        |
| 12                                           | 06    | 120        |
| 240                                          | 7.02  | 240        |
| 120                                          |       | 120        |
| 14.40                                        | 16.4) | 1440       |
| 2. Add                                       | 656   | 106        |
| 16.40                                        | 514   | 864.00     |
|                                              | 492   | 240 Add    |
|                                              | 223   | 1104       |
|                                              | 164   | 7.2 Deduct |
|                                              | 596   | 1096.8     |
|                                              | 492   | 64.5       |
|                                              | 1040  | 54840      |
|                                              | 984   | 43872      |
|                                              | 560   | 65808      |
|                                              | 492   | 70743.60   |
| Ans. 4313 <i>l.</i> 12 <i>s.</i> 8 <i>d.</i> | 680   |            |
| According to Simple                          | 656   |            |
| Interest.                                    |       |            |
|                                              | 24    | The        |

# Compound Interest.

363

The Work, according to Compound Interest.

First, If 6 : 100 :: 64.5 : *Facit* 1075 Cor. Principal.

6) 64500 (1075

6

045

42

*Ans.* 1075 l. 00 s. 3 d.  
according to Comp. Interest.

30

30

Log. of the Rate  
Multiply by the Time

0253059

120

5061180

253059

Log. of the Rate and Time

3.0367080

Log. of the Cor. Principal 1075, is

3.0314684

Log. of the Rate and Time, is

3.0367080

Difference is

9.9947084

Which is the Logarithm of .98788, which subtracted from the Cor. Principal, leaves the present Worth,

*Viz.* 1074.01212, which is equal to 1074 l. 0 s. 3 d.

The Work, as a Freehold Estate at 6 per Cent. Compound Interest.

.06) 64.50 (1075

045

42

*Ans.* 1075 l. as a  
Freehold Estate.

30

30

0

A a a

The



$\begin{array}{r} \text{The present Worth at 6 per Cent. Simp. Int. is } 4313 \text{ } 12 \text{ } 8 \\ \text{The present Worth at 6 per Cent. Comp. Int. is } 1074 \text{ } 0 \text{ } 3 \\ \text{Difference of the Worth is } 3239 \text{ } 12 \text{ } 5 \\ \text{The present Worth, as a Freehold Estate, at 6 per Cent.} \\ \text{Compound Interest, is } 1075 \text{ } l. \end{array}$

By which you may see it is better to purchase it at Compound Interest, by 3239  $l.$  12  $s.$  5  $d.$  which is a very great Difference, being more than the Estate is worth for ever.

And though the present Worth of this Estate, to continue 120 Years, at 6 per Cent. Compound Interest, comes so near the Worth of the same Estate to continue for ever, the same Rate of Interest being computed; yet if this Estate were to continue 200 Years, nay double that Time, yet it would not reach 1075  $l.$ ; which shews the Agreement of the Rules: For if it were otherwise, it would not be found better to purchase an Annuity for ever, than for a certain Number of Years; which would be a Paradox.

## QUEST. V.

A Gentleman pays 350  $l.$  for a Lease in Reversion, to commence at the End of 13 Years and a Quarter, and to continue for 21 Years and 2 Quarters: What quarterly Rent may he let the Premises for after he comes to be in Possession thereof, so as to gain 8 per Cent. Compound Interest for his Money?

$\begin{array}{r} \text{The Log. of } 350 \text{ } l. \quad 2.5440689 \\ \text{Worth of } 1 \text{ } l. \text{ forborn } 53 \text{ Quarters} = 0.4428627 \end{array}$

$\begin{array}{r} \text{Log. of the Increase of } 350 \text{ } l. \text{ i. e. of } 970.4 = 2.9869307 \\ \text{The Log. of the Annuity that } 1 \text{ } l. \text{ will } \} = 2.3689282 \\ \text{purchase for } 87 \text{ Quarters.} \end{array}$

Sum of the Log. of 22,69 the Answer.  $= 1.3558589$

# PROBLEMS, or QUESTIONS

I N

## A L G E B R A.

1. **T**O find a Number, which being multiplied by 3, subtracting 5 from the Product, and the Remainder divided by 2, if the Number sought be added to the Quotient, that the Sum may be 40.

2. To find a Number, which being multiplied by 12, and 48 added to the Product, as much may be produced, as if the same Number sought were multiplied by 18.

3. To find a Number, to which if 11 be added, and 7 subtracted from the same Number (*viz.* the first) the Sum of the Addition may be double the Remainder.

4. To find a Number, to which if its double, treble, quadruple, &c. be added, the Square of the same Number may be produced.

5. To find a Number, which if added to itself, and the Sum multiplied by the same; and the same Number still subtracted from the Product; and, lastly, the Remainder divided by the same, that it may produce 13.

6. To divide the Number 16 into two Parts; so that the Square of the greater Part may exceed the Square of the less by 32.

7. To divide the Number 36 into two Parts; so that if 12 be added to the first, and 6 to the second, the former may be double of the latter.

8. Let the Line A B (of 70 Parts) be divided any how in C (so that A C may be 24, B C 48)? it is required to divide the same Line again in another Point; *for Example*, in D, so that the Rectangle A D C may be equal to the Square D B: Let the Segment C D be enquired; which being obtained, A D, D B will be known.

9. Let the Line E F be divided any how in G, (so that F G may be 6, G F 4); it is required to produce this right Line E F (for Example unto H) so that the Rectangle E H F may be equal to the Square G H; the Length of F H is required.

10. A General disposing his Army into a Square Battle, finds he has 284 Soldiers over and above; but increasing each Side with one Soldier, he wants 25 Soldiers to fill up the Square: How many Soldiers had he?

11. A certain Captain sends out  $\frac{1}{2}$  of his Soldiers + 10, there remain  $\frac{1}{2} + 15$ : How many Soldiers had he?

12. There is an Army, to which if you add  $\frac{1}{2}$ ,  $\frac{2}{3}$ , and  $\frac{3}{4}$  of itself, and take away 5000, the Sum Total will be 100000: What was the Number of the Army?

13. In the Rectangle A B C D, the Difference of the greater Side A B, and of the lesser Side B C, is 12; but the Difference of the Squares of the Sides 1680: What are the Sides of the Rectangle A B C D?

14. The Length D E of the Rectangle D E F G, is twice the Breadth E F; and the Sum of the Squares of the Length and Breadth is ten times the Sum of the two Sides D E, E F: What are the Sides of the Rectangle D E F G?



15. To find two Numbers in the Proportion of 2 to 3, whose Product, if they be multiplied by one another, shall be 54.

16. To find two Numbers whose Ratio is to one another as 4 to 5; and the Sum of the Squares of both, is 262.

17. To find the Side of a Square, whose Area is to the Sum of the Sides, in a given Ratio, as 45 to 12.

18. To find the Side of a Cube, whose Superficies is to the Solidity, in a given Ratio, as 6 to 11.

19. A certain Man hires a Labourer, on this Condition; that for every Day he work'd, he should receive 12 Pence; but for every Day he was idle, he should be mulcted 8 Pence: When 390 Days were past, neither of them were indebted to one another: How many Days did he work, and how many was he idle?

20. A certain Gentleman hires a Servant, and promises him 24 Pounds yearly Wages, together with a Cloak: At 8 Months end the Servant obtains leave to go away, and instead of his Wages receives a Cloak + 13 Pounds: How much did the Cloak cost?

21. A Person being ask'd how old he was, answer'd, If I quadruple  $\frac{2}{3}$  of my Years, and add  $\frac{1}{2}$  of them + 50 to the Product, the Sum will be so much above 100, as the Number of my Years is now below 100.

22. One being ask'd what Hour of the Day it was, answered, The Day at this Time is 16 Hours long; if now  $\frac{1}{2}$  of the Hours past be added to  $\frac{2}{3}$  of the Remainder, you will have the Hour desired, reckoning from Sun-rising.

23. From Noremberg to Rome are 140 Miles: A Traveller sets out at the same Time from each of the two Cities, one goes 8 Miles a Day, the other 6: In how

many Days from their first setting out will they meet one another, and how many Miles did each of them go?

24. A certain Messenger goes 6 Miles every Day: Eight Days after, another follows him, and he goes 10 Miles a Day: In what Number of Days will he come up to the first?

25. A certain Messenger goes 6 Miles a Day; and after he has gone 56 Miles, another follows him, who goes 8 Miles a Day: In how many Days will he come up to him?

26. One bought three Books, whose Prices were in proportion as 12, 5, 1: If the Price of the first be doubled, of the second trebled, of the third quadrupled, the Sum of these Products will as much exceed 10 Crowns, as the Sum of the Prices of the greatest and middle is below 5: How much did the said Books cost?

27. Suppose the Number 50 were to be divided into two Parts, so that the greater Part being divided by 7, and the less multiplied by 3, the Sum of this Product and the former Quotient may make the same Number proposed, which was 50.

28. Let the Number 20 be divided into two Parts, so that the Square of the lesser Part, being taken out of the Square of the greater, may leave the very Number proposed, which was 20 (or may leave the double, treble, &c. of the Number proposed).

29. If a Man gains 30 Crowns a Week: How much must he spend a Week to have 500 Crowns, together with the Expence of four Weeks, remaining at the Year's End?

30. A Labourer after 40 Weeks, in which he had been at work, lays up 28 Crowns—the Pay of three Weeks; and finds that he had expended 36 Crowns—the Pay of eleven Weeks: What Pay did he receive a Week?

31. In the Rectangle  $ABC$ , is given the Basis  $AB=9$ , and the Difference of the other Sides, that is, the Segment  $BD=3$ : Required, the Sides  $AC, BC$ ?

32. In the Rectangled Triangle  $ABC$ , is given the Basis  $AB=5$ , and the Sum of the other Sides  $AC+BC=25$ : Required, the Sides  $AC, BC$  severally?

33. Suppose two Towers,  $AB$  180 Feet high, and  $CD$  240, at the Distance  $AC$  360 Feet: A Ladder is to be set upon the Line  $AC$ , at some Point, suppose in  $E$ , of such a Length, as from thence it may reach the Top of both the Towers: We require the Point  $E$  in the Line of Distance, as also the Length of the Ladder  $EB, ED$ ?

34. In the Triangle  $ABC$ , the several Sides  $AB=13$ ,  $AC=14$ ,  $BC=15$  are given; and the Perpendicular  $BD$  being drawn: Required, the Segments of the Basis  $AD, DC$ ?

35. In the Obtuse-angled Triangle  $DEF$ , the several Sides are given, viz.  $DE$  11,  $EF$  13,  $DF$  20; and the Perpendicular  $FG$ , being let fall upon the Basis produced: Required, the Prolongation of the Basis  $EG$ .

36. In the Rectangle  $ABCD$ , is given the Difference between the Length  $AB$  and the Diagonal  $BD$ , that is  $DE=2$ ; and likewise the Difference between the Breadth  $AD$  and the Diagonal  $BD$ , that is,  $FB=9$ : Required, the Sides of the Rectangle  $AB, AD$ ?

37. In the Rectangle  $DEFG$ , the right Line  $DK$  is drawn, from the Angle  $D$  to the opposite Side, cutting the Diagonal  $EG$  at right Angles in  $H$ : And there is given the Segment  $HK=2$ , and  $HE=26$ : Required, the Sides of the Rectangle?



38. Let there be a Circle, whose Diameter is  $AB$ , with another less Circle, whose Diameter  $AC$  touches within in  $A$ ; and from the Center of the greater Circle  $D$ , draw the Radius  $DE$  at right Angles to  $AB$ , cutting the Periphery of the lesser Circle in  $E$ . Now there is given  $BC$  (the Difference of the Diameters)  $= 9$ , with the Segment  $EF = 5$ : Required the Diameters  $AB$ ,  $AC$  of the said Circles?

39. Two Companions have got a Parcel of Guineas: Says  $A$  to  $B$ , if you will give me one of your Guineas, I shall have as many as you will have left. Nay, replies  $B$ , if you will give me one of your Guineas, I shall have twice as many as you will have left: How many Guineas had each of them?

40. A certain Person bought two Horses, with the Trappings, which cost 100 Pounds; which Trappings if laid on the first Horse  $A$ , both the Horses will be of equal Value: But if the Trappings be laid on the other Horse, he will be double the Value of the first: How much did the said Horses cost?

41. A Vintner has two Sorts of Wine, viz.  $A$  and  $B$ , which if mix'd in equal Parts, a Flaggon of mix'd will cost 15 Pence; but if they be mixed in a *sesqui-alter* Proportion, as if you should take two Flaggons of  $A$  as often as you take three of  $B$ , a Flaggon will cost 14 Pence: Required the Price of each Wine singly?

42. A Son ask'd his Father how old he was? His Father answered him thus: If you take away 5 from my Years, and divide the Remainder by 8, the Quotient will be  $\frac{1}{2}$  of your Age: But if you add 2 to your Age, and multiply the Whole by 3, and then subtract 7 from the Product, you will have the Number of the Years of my Age: What was the Age of the Father and Son?

43. To find out two Numbers, to the Sum whereof if you add 6, the Whole shall double the greater; and if you subtract 2 from their Difference, the Remainder will be half of the least.

44. To find two Numbers, the Product whereof is 240, and the Triple of the greater divided by the less is 5.

45. Two Men have a mind to purchase a House rated at 1200 Pounds; says *A* to *B*, If you give me  $\frac{2}{3}$  of your Money, I can purchase the House alone; but says *B* to *A*, If you will give me  $\frac{3}{4}$  of yours, I shall be able to purchase the House: How much Money had each of them?

46. Some young Men and Maids had a Reckoning of 37 Crowns to pay for a Treat, and this was their Conditions, that every young Man should pay 3 Crowns, and every Maid 2. Now if there had been as many young Men as there were Maids, observing the same Conditions, the Reckoning would have come to 4 Crowns less than it did: How many young Men and Maids were there?

47. A General who had fought a Battle, upon reviewing his Army, whose Foot was thrice the Number of his Horse, finds that before the Battle  $\frac{1}{12}$ —120 of his Foot had deserted, and of his Horse  $\frac{1}{10}$ +120, besides  $\frac{1}{4}$  of his whole Army were sent into Garrison (reckoning the Sick and Wounded) and  $\frac{3}{4}$  of his Army remained; the rest, who were wanting, being either slain or taken Prisoners: Now if you add 3000 to the Number of the Slain, the Sum will be equal to half the Foot he had at the beginning: What were the Number of each?

48. To divide 100 twice into two Parts, so that the *major* Part of the first Division may be treble the *minor* Part

B b b

Part

Part of the second Division; and the *major* Part of the second may be double the *minor* Part of the first.

49. To divide 30 twice into two Parts, so that the *major* Part of the first Division with the *minor* of the second may be 33; and the Sum of the *minor* Parts subtracted from the Sum of the *major*, may leave 14 remaining.

50. A Man, his Wife, and his Son's Age make up 96 Years; so that the Husband's and Son's Years together make the Wife's + 15; but the Wife's and the Son's make the Husband's + 2: What was the Age of each?

51. Three Merchants from three different Fairs meet together at an Inn, where they reckon up their Gains, and find them the Sum of 780 Crowns. Moreover, if you add the Gain of the first and second, and subtract the Gain of the third from the Sum, there remains the Gain of the first + 82 Crowns; but if you add the Gain of the second and third, and from the Sum subtract the Gain of the first, there remains the Gain of the third—43 Crowns: What was the Gain of each?

52. Three Persons, *A*, *B*, *C*, owe a certain Sum of Money, so that *A* and *B* together owe 210 Crowns; *B* and *C* 290, and *C* and *A* 400: What did each of them owe?

53. To find three Numbers, so that the first and half of the Remainder, the second and  $\frac{1}{3}$  of the Remainder, and the third and  $\frac{1}{4}$  of the Remainder, may always make 34.

54. Let a Square be divided into 9 small Squares: We are to find and dispose the Numbers through the several *Areas*, so that the Sum of every three, taken either literally or diagonally, may be always 15.



55. [ Theorem. ] Let any Numbers whatsoever be given, if you subtract every less Number from that which is the next greatest; I say, that the Sum of those Differences is equal to the Difference of the greatest and least Numbers.

56. To find a Number, which being multiplied by 6, and the Product subtracted from the Square of the Number to be found, the Remainder will be 280.

57. To find a Number, which being multiplied by 8, and the Product added to the Square of the Number to be found, the Sum will be 660.

58. To divide 140 into two Parts, so that the Product of those Parts may be the Square of 56, that is 3136.

59. Let 960 Soldiers be drawn up into an oblong Battle, so that the Difference of the greater and less Sides is 40: Required the Number of the Soldiers of each Rank in Length and Breadth?

60. Again, let 480 Soldiers be drawn up into an oblong Battle, so that the Sum of the greater and less Sides is 52: Required the Number of the Soldiers of each Rank in Length and Breadth?

61. In the Square  $ABCD$  is given the Difference of the Diagonal and the Side, that is  $EC=6$ : Required the Side of the Square?

62. The Rectangle  $E K$  is added to the Square  $D F$  (being of the same Height;) whose Breadth  $E L$  is given  $= 2$ , and also the Area of the whole compound Rectangle  $D K$ ,  $= 60$ : Required the first Side of the Square?

63. A Man buys some Ells of Cloth for 70 Crowns; and finds, that if he had 4 Ells more, he had then bought every Ell 2 Crowns cheaper: How many Ells did he buy?

64. A Set of boon Companions dining at an Inn, the Reckoning in all came to 175 Shillings: But, before the Bill was paid off, two of them slunk away, and then the Club of those that remained came to 10 Shillings a Man more: How many were there in Company?

65. To divide the Number 21 into two Parts, so that if the greater be divided by the lesser, and again the lesser by the greater, and then the first Quotient being multiplied by 4, and the latter by 25, the Numbers produced may be equal.

66. Let the Line  $A B$  be divided in  $C$ , so that  $A C$  may be 8, and  $C D$  6: We are to divide the same Line  $A B$  in  $D$ , so that the Rectangle under  $A B$  and  $D C$  may be equal to the Rectangle under  $A C$  and  $C B$ , or to the Product from 8 and 6, which is 48: Required the Segment  $C D$ ?

67. Let there be a Rectangle Garden  $ABCD$ , the Length of which  $AB$  is thrice the Breadth  $AD$ : and reckoning 18 Perches from  $B$  towards  $A$ , that is  $BE$ , and drawing  $EF$  parallel to  $AD$ , let the Area of the remaining Rectangle  $E D$  be given  $= 120$  square Perches: What was the Length and Breadth of the said Garden?

68. Let 600 Soldiers be disposed into an oblong Battle; which the Colonel willing to make broader, finds that if he takes away 10 Ranks from the Length, he shall augment the Breadth with two Ranks: What was the Number of his Soldiers through every Rank in Length and Breadth?

68. A Man buys a Horse, which he sells again for 56 Crowns, and gains as many Crowns in 100 as the Horse cost him? How much did he give for the Horse?

70. A certain Linnen-Draper buys two Sorts of Linnen for 30 Crowns, one finer, the other coarser. An Ell of the finest cost as many Crowns as he had Ells: And also 28 Ells of the coarsest at such a Price, that 8 Ells cost as many Crowns as one Ell of the finest: How many Ells of the finest Linnen did he buy, and what Price did he give for them both?

71. In a certain Rectangular Garden, the Length of which  $AD$  is 22 Perches, and the Breadth  $AD$  is 10, the Walk  $DG$  is to be made in a Situation parallel to the Sides of the Figure, so that the Area of the said Walk or Gnomon  $DG$  may be equal to the remaining Rectangle  $FC$ , or that the Gnomon  $DG$  may be half of the whole Figure  $ABCD$  proposed: Required the Breadth of the said Gnomon  $DE$ , or  $BG$ ?



72. Of three proportional Numbers there is the middle Term given  $= 12$ , and the Difference of the Extremes  $= 10$ : Required the Extremes.

73. Of three proportional Numbers there is given the Sum of the first and second  $= 10$ , and the Difference of the second and third  $= 24$ : Required the several Numbers?

74. Of four proportional Numbers there is given the third  $= 12$ , also the Sum of the first and second  $= 8$ ; besides the second Number being subtracted from its Square, the Remainder is to be the fourth: Required the said Numbers?

75. Of four Numbers in continued Proportion there is given the Sum of the Means  $= 24$ , and likewise the Sum of the Extremes  $= 56$ : Required the said Numbers (supposing that the first is the least of all)?

76. Two Country-women, *A* and *B*, carry 100 Eggs together to Market, and in the Sale of them, one took as much Money as the other: but *A* (who had the largest, and consequently the best Eggs) says to *B*, had I carried as many Eggs as you, I should have had 18 Pence for them; *B* replies, if I had brought as many Eggs as you, I should have had but 8 Pence for them: How many Eggs had each?

77. Two Country-men, *A* and *B*, sell their Corn at different Prices: *A* sells 20 Bushels; and *B* received for one Bushel as many Crowns as he sold Bushels: *A* perceives that if he had sold as many Bushels as *B* received Crowns, he should then have received 252 Crowns; but both together received 176 Crowns: How many Bushels did *B* sell, and what Price had *A*?

78. Two Merchants sell 21 Ells of Cloth: The first sells 1 Ell for as many Crowns, as is  $\frac{1}{3}$  of the Number of Ells that the second had; and the second sells 1 Ell for as many Crowns, as is  $\frac{1}{4}$  of the Number of the Ells that the first had: The Sale being over, they had taken 48 Crowns in all: How many Ells did each sell, and at what Price?

79. Two Merchants have a Parcel of Silk; the first 40 Ells, the second 90: The first sells for a Crown  $\frac{1}{3}$  of an Ell more than the second: When the Sale was over, they had taken between them 42 Crowns: How many Ells did each of them sell for a Crown?

80. To find a Number, to the quadruple of which if you add 91, the Whole shall be to the Square of the Number sought, as 3 to 4.

81. To find a Number, from the double of which if you subtract 12, the Square of the Remainder less 1, will be nine times the Number sought.

82. To divide the Number 19 into two Parts, so that the Sum of the Squares of the Parts will be 193.

83. To divide 7 into two Parts, so that the Difference of the Squares, which are made from the Treble of the lesser Part, and the Double of the greater, may be 17.

84. A Man buys a Piece of Linnen, and by selling it again, he gains 12 Crowns— $\frac{1}{10}$  of what he bought it for: And finds by this means that he had gained as much for 100 Crowns as the Linnen cost him: What Price was the Linnen bought and sold at?

85. A Man buys 18 Ells of Cloth of different Sorts and Colours, suppose Red and Black; what he bought of each cost 40 Crowns: And he pays for every Ell of Red Cloth 1 Crown more than for the Black: How many Ells of each did he buy?

86. A Man buys 123 Pounds of Pepper, and as many of Ginger; and received for a Crown one Pound of Ginger more than of Pepper: So that the whole Price of the Pepper came to 6 Crowns more than the Price of the Ginger: How many Pounds of each did he buy for a Crown?

87. A Man buys 80 Pounds of Pepper and 36 Pounds of Saffron, so that for 8 Crowns he had 14 Pounds of Pepper more than he had of Saffron for 26 Crowns, and what he laid out amounted to 188 Crowns: How many Pounds of Pepper had he for 8 Crowns, and how many of Saffron for 26?

88. *A* and *B* between them owe 174 Pounds, *A* pays 8 Pounds a Day, and *B* pays the first Day 1 Pound, the second 2, the third 3, and so on: In how many Days will they clear the Debt, and how much did each of them owe?

89. A certain Man intends to travel as many Days as he has Crowns: It happens, that every following Day of his Journey he has as many Crowns as he had the Day before, besides two Crowns over and above; and when he came to his Journey's End he finds he had in all 45 Crowns: How many Crowns had he at first?

90. A certain Traveller goes 9 Miles a Day, three Days after another follows him, who the first Day travels 4 Miles, the second 5, the third 6, and so on, gaining a Mile every Day: In what Time will he overtake the former?



91. Two Travellers set out at the same time from two Cities, the one from A, and the other from B, which are 70 Miles distant one from another; one of them goes 6 Miles every Day; and the other 2 Miles the first Day,  $2\frac{1}{2}$  the second, 3 the third, and so on, adding  $\frac{1}{2}$  a Mile to every Day's Journey. In what Time will they meet with one another?

92. Again, Two Travellers set out at the same time from two Cities, the one from A, and the other from B, which are 120 Miles distant from one another; the first goes 5 Miles a Day, and the other 3 Miles less than the Number of Days in which they meet. When will they meet?

93. A Post sets out from A towards B, who travels 8 Miles a Day: After he had gone 27 Miles, another sets out from B to meet him, who goes every Day  $\frac{1}{30}$  of the whole Journey or Distance of the Places A and B, and meets the first Post after so many Days as is  $\frac{1}{30}$  of the said Distance. Required the Distance of A and B?

94. Two Merchants, A and B, go Partners; B brings 420 Crowns, and A receives out of the Gain 52 Crowns, and the Sum of both their Shares is 854 Crowns. How much did A bring, and how much did B receive out of the Gain?

95. A Son asks his Father how old he was? His Father replies thus; If you take 4 from my Age, the Remainder will be twice the Number of your Years: But if you take 1 from your Age, half the Remainder will be the Square Root of my Age. Required the Age of the Father and Son?

96. To find two Numbers, the Sum of whose Squares may be 317, and the Product, if they be multiplied by one another, 154.

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97. To find two Numbers, the Product of which may be 108, and the Difference of the Squares 63.

98. Two Farmers sell two Sorts of Corn: A sells 6 Bushels; B receives in all for his, 20 Crowns: Now, says B to A, if we add the Number of my Bushels to the Number of your Crowns, the Sum will be 28. Says A to B, and if I add the Square of my Crowns to the Square of your Bushels, the Sum will be 424. How many Bushels did B sell, and how many Crowns did A receive?

99. To find two Numbers, the first of which  $+ 2$ , multiplied into the second  $- 3$ , may produce 110: And on the contrary, the first  $- 3$ , multiplied by the second  $+ 2$ , may produce 80.



A  
TABLE  
OF  
LOGARITHMS  
FOR  
NATURAL NUMBERS,  
From 1, to 10,000.

Ccc 2

A



TABLE  
OF  
LOGARITHMS

FOR

NATURAL NUMBERS,

FROM 1, TO 10,000.



A

1000

# A TABLE of LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 1              | 0.0000000 | 34             | 1.5314789 | 67             | 1.8260748 |
| 2              | 0.3010300 | 35             | 1.5440680 | 68             | 1.8325089 |
| 3              | 0.4771213 | 36             | 1.5563025 | 69             | 1.8388491 |
| 4              | 0.6020600 | 37             | 1.5682017 | 70             | 1.8450980 |
| 5              | 0.6989700 | 38             | 1.5797836 | 71             | 1.8512583 |
| 6              | 0.7781513 | 39             | 1.5910646 | 72             | 1.8573325 |
| 7              | 0.8450980 | 40             | 1.6020600 | 73             | 1.8633229 |
| 8              | 0.9030900 | 41             | 1.6127839 | 74             | 1.8692317 |
| 9              | 0.9542425 | 42             | 1.6232493 | 75             | 1.8750613 |
| 10             | 1.0000000 | 43             | 1.6334685 | 76             | 1.8808136 |
| 11             | 1.0413927 | 44             | 1.6434527 | 77             | 1.8864907 |
| 12             | 1.0791812 | 45             | 1.6532125 | 78             | 1.8920946 |
| 13             | 1.1139434 | 46             | 1.6627578 | 79             | 1.8976271 |
| 14             | 1.1461280 | 47             | 1.6720979 | 80             | 1.9030900 |
| 15             | 1.1760913 | 48             | 1.6812412 | 81             | 1.9084850 |
| 16             | 1.2041200 | 49             | 1.6901961 | 82             | 1.9138139 |
| 17             | 1.2304489 | 50             | 1.6989700 | 83             | 1.9190781 |
| 18             | 1.2552725 | 51             | 1.7075702 | 84             | 1.9242793 |
| 19             | 1.2787536 | 52             | 1.7160033 | 85             | 1.9294189 |
| 20             | 1.3010300 | 53             | 1.7242759 | 86             | 1.9344985 |
| 21             | 1.3222193 | 54             | 1.7323938 | 87             | 1.9395193 |
| 22             | 1.3424227 | 55             | 1.7403627 | 88             | 1.9444827 |
| 23             | 1.3617278 | 56             | 1.7481880 | 89             | 1.9493900 |
| 24             | 1.3802112 | 57             | 1.7558749 | 90             | 1.9542425 |
| 25             | 1.3979400 | 58             | 1.7634280 | 91             | 1.9590414 |
| 26             | 1.4149733 | 59             | 1.7708520 | 92             | 1.9637878 |
| 27             | 1.4313638 | 60             | 1.7781513 | 93             | 1.9684829 |
| 28             | 1.4471580 | 61             | 1.7853298 | 94             | 1.9731279 |
| 29             | 1.4623980 | 62             | 1.7923917 | 95             | 1.9777236 |
| 30             | 1.4771213 | 63             | 1.7993405 | 96             | 1.9822712 |
| 31             | 1.4913617 | 64             | 1.8061800 | 97             | 1.9867717 |
| 32             | 1.5051500 | 65             | 1.8129134 | 98             | 1.9912261 |
| 33             | 1.5185139 | 66             | 1.8195439 | 99             | 1.9956352 |
| 34             | 1.5314789 | 67             | 1.8260748 | 100            | 2.0000000 |

# 100 A TABLE of LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 101            | 2.0043214 | 134            | 2.1271048 | 167            | 2.2227165 |
| 102            | 2.0086002 | 135            | 2.1303338 | 168            | 2.2253093 |
| 103            | 2.0128372 | 136            | 2.1335389 | 169            | 2.2278867 |
| 104            | 2.0170333 | 137            | 2.1367206 | 170            | 2.2304489 |
| 105            | 2.0211893 | 138            | 2.1398791 | 171            | 2.2329961 |
| 106            | 2.0253059 | 139            | 2.1430148 | 172            | 2.2355284 |
| 107            | 2.0293838 | 140            | 2.1461280 | 173            | 2.2380461 |
| 108            | 2.0334238 | 141            | 2.1492191 | 174            | 2.2405492 |
| 109            | 2.0374265 | 142            | 2.1522883 | 175            | 2.2430380 |
| 110            | 2.0413927 | 143            | 2.1553360 | 176            | 2.2455127 |
| 111            | 2.0453230 | 144            | 2.1583625 | 177            | 2.2479733 |
| 112            | 2.0492180 | 145            | 2.1613680 | 178            | 2.2504200 |
| 113            | 2.0530784 | 146            | 2.1643529 | 179            | 2.2528530 |
| 114            | 2.0569048 | 147            | 2.1673173 | 180            | 2.2552725 |
| 115            | 2.0606978 | 148            | 2.1702617 | 181            | 2.2576786 |
| 116            | 2.0644580 | 149            | 2.1731863 | 182            | 2.2600714 |
| 117            | 2.0681859 | 150            | 2.1760913 | 183            | 2.2624511 |
| 118            | 2.0718820 | 151            | 2.1789769 | 184            | 2.2648178 |
| 119            | 2.0755470 | 152            | 2.1818436 | 185            | 2.2671717 |
| 120            | 2.0791812 | 153            | 2.1846914 | 186            | 2.2695129 |
| 121            | 2.0827854 | 154            | 2.1875207 | 187            | 2.2718416 |
| 122            | 2.0863598 | 155            | 2.1903317 | 188            | 2.2741578 |
| 123            | 2.0899051 | 156            | 2.1931246 | 189            | 2.2764618 |
| 124            | 2.0934217 | 157            | 2.1958997 | 190            | 2.2787536 |
| 125            | 2.0969100 | 158            | 2.1986571 | 191            | 2.2810334 |
| 126            | 2.1003705 | 159            | 2.2013971 | 192            | 2.2833012 |
| 127            | 2.1038037 | 160            | 2.2041200 | 193            | 2.2855573 |
| 128            | 2.1072100 | 161            | 2.2068259 | 194            | 2.2878017 |
| 129            | 2.1105897 | 162            | 2.2095150 | 195            | 2.2900346 |
| 130            | 2.1139434 | 163            | 2.2121876 | 196            | 2.2922561 |
| 131            | 2.1172713 | 164            | 2.2148438 | 197            | 2.2944662 |
| 132            | 2.1205739 | 165            | 2.2174839 | 198            | 2.2966652 |
| 133            | 2.1238516 | 166            | 2.2201081 | 199            | 2.2988531 |
| 134            | 2.1271048 | 167            | 2.2227165 | 200            | 2.3010300 |



200 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 201            | 2.3031961 | 234            | 2.3692159 | 267            | 2.4265113 |
| 202            | 2.3053514 | 235            | 2.3710679 | 268            | 2.4281348 |
| 203            | 2.3074960 | 236            | 2.3729120 | 269            | 2.4297523 |
| 204            | 2.3096302 | 237            | 2.3747483 | 270            | 2.4313638 |
| 205            | 2.3117539 | 238            | 2.3765770 | 271            | 2.4329693 |
| 206            | 2.3138672 | 239            | 2.3783979 | 272            | 2.4345689 |
| 207            | 2.3159703 | 240            | 2.3802112 | 273            | 2.4361626 |
| 208            | 2.3180633 | 241            | 2.3820170 | 274            | 2.4377506 |
| 209            | 2.3201463 | 242            | 2.3838154 | 275            | 2.4393327 |
| 210            | 2.3222193 | 243            | 2.3856063 | 276            | 2.4409091 |
| 211            | 2.3242825 | 244            | 2.3873898 | 277            | 2.4424798 |
| 212            | 2.3263359 | 245            | 2.3891661 | 278            | 2.4440448 |
| 213            | 2.3283796 | 246            | 2.3909351 | 279            | 2.4456042 |
| 214            | 2.3304138 | 247            | 2.3926969 | 280            | 2.4471580 |
| 215            | 2.3324385 | 248            | 2.3944517 | 281            | 2.4487063 |
| 216            | 2.3344538 | 249            | 2.3961993 | 282            | 2.4502491 |
| 217            | 2.3364597 | 250            | 2.3979400 | 283            | 2.4517864 |
| 218            | 2.3384565 | 251            | 2.3996737 | 284            | 2.4533183 |
| 219            | 2.3404441 | 252            | 2.4014005 | 285            | 2.4548449 |
| 220            | 2.3424227 | 253            | 2.4031205 | 286            | 2.4563660 |
| 221            | 2.3443923 | 254            | 2.4048337 | 287            | 2.4578819 |
| 222            | 2.3463530 | 255            | 2.4065402 | 288            | 2.4593925 |
| 223            | 2.3483049 | 256            | 2.4082400 | 289            | 2.4608978 |
| 224            | 2.3502480 | 257            | 2.4099331 | 290            | 2.4623980 |
| 225            | 2.3521825 | 258            | 2.4116197 | 291            | 2.4638930 |
| 226            | 2.3541084 | 259            | 2.4132998 | 292            | 2.4653829 |
| 227            | 2.3560259 | 260            | 2.4149733 | 293            | 2.4668676 |
| 228            | 2.3579348 | 261            | 2.4166405 | 294            | 2.4683473 |
| 229            | 2.3598355 | 262            | 2.4183013 | 295            | 2.4698220 |
| 230            | 2.3617278 | 263            | 2.4199557 | 296            | 2.4712917 |
| 231            | 2.3636120 | 264            | 2.4216039 | 297            | 2.4727564 |
| 232            | 2.3654880 | 265            | 2.4232459 | 298            | 2.4742163 |
| 233            | 2.3673559 | 266            | 2.4248816 | 299            | 2.4756712 |
| 234            | 2.3692159 | 267            | 2.4265113 | 300            | 2.4771213 |

# 300 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 301            | 2.4785665 | 334            | 2.5237465 | 367            | 2.5646661 |
| 302            | 2.4800069 | 335            | 2.5250448 | 368            | 2.5658478 |
| 303            | 2.4814426 | 336            | 2.5263393 | 369            | 2.5670264 |
| 304            | 2.4828736 | 337            | 2.5276299 | 370            | 2.5682017 |
| 305            | 2.4842998 | 338            | 2.5289167 | 371            | 2.5693739 |
| 306            | 2.4857214 | 339            | 2.5301997 | 372            | 2.5705429 |
| 307            | 2.4871384 | 340            | 2.5314789 | 373            | 2.5717088 |
| 308            | 2.4885507 | 341            | 2.5327544 | 374            | 2.5728716 |
| 309            | 2.4899585 | 342            | 2.5340261 | 375            | 2.5740313 |
| 310            | 2.4913617 | 343            | 2.5352941 | 376            | 2.5751878 |
| 311            | 2.4927604 | 344            | 2.5365584 | 377            | 2.5763414 |
| 312            | 2.4941546 | 345            | 2.5378191 | 378            | 2.5774918 |
| 313            | 2.4955443 | 346            | 2.5390761 | 379            | 2.5786392 |
| 314            | 2.4969296 | 347            | 2.5403295 | 380            | 2.5797836 |
| 315            | 2.4983106 | 348            | 2.5415792 | 381            | 2.5809250 |
| 316            | 2.4996871 | 349            | 2.5428254 | 382            | 2.5820634 |
| 317            | 2.5010593 | 350            | 2.5440680 | 383            | 2.5831988 |
| 318            | 2.5024271 | 351            | 2.5453071 | 384            | 2.5843312 |
| 319            | 2.5037907 | 352            | 2.5465427 | 385            | 2.5854607 |
| 320            | 2.5051500 | 353            | 2.5477747 | 386            | 2.5865873 |
| 321            | 2.5065050 | 354            | 2.5490033 | 387            | 2.5877110 |
| 322            | 2.5078559 | 355            | 2.5502284 | 388            | 2.5888317 |
| 323            | 2.5092025 | 356            | 2.5514500 | 389            | 2.5899496 |
| 324            | 2.5105450 | 357            | 2.5526682 | 390            | 2.5910646 |
| 325            | 2.5118834 | 358            | 2.5538830 | 391            | 2.5921768 |
| 326            | 2.5132176 | 359            | 2.5550944 | 392            | 2.5932861 |
| 327            | 2.5145478 | 360            | 2.5563025 | 393            | 2.5943926 |
| 328            | 2.5158738 | 361            | 2.5575072 | 394            | 2.5954962 |
| 329            | 2.5171959 | 362            | 2.5587086 | 395            | 2.5965971 |
| 330            | 2.5185139 | 363            | 2.5599066 | 396            | 2.5976952 |
| 331            | 2.5198280 | 364            | 2.5611014 | 397            | 2.5987905 |
| 332            | 2.5211381 | 365            | 2.5622929 | 398            | 2.5998831 |
| 333            | 2.5224442 | 366            | 2.5634811 | 399            | 2.6009729 |
| 334            | 2.5237465 | 367            | 2.5646661 | 400            | 2.6020600 |

# 400 A TABLE of LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 401            | 2.6031444 | 434            | 2.6374897 | 467            | 2.6693169 |
| 402            | 2.6042261 | 435            | 2.6384893 | 468            | 2.6702459 |
| 403            | 2.6053050 | 436            | 2.6394865 | 469            | 2.6711728 |
| 404            | 2.6063814 | 437            | 2.6404814 | 470            | 2.6720979 |
| 405            | 2.6074550 | 438            | 2.6414741 | 471            | 2.6730209 |
| 406            | 2.6085260 | 439            | 2.6424645 | 472            | 2.6739420 |
| 407            | 2.6095944 | 440            | 2.6434527 | 473            | 2.6748611 |
| 408            | 2.6106602 | 441            | 2.6444386 | 474            | 2.6757783 |
| 409            | 2.6117233 | 442            | 2.6454223 | 475            | 2.6766934 |
| 410            | 2.6127839 | 443            | 2.6464037 | 476            | 2.6776070 |
| 411            | 2.6138418 | 444            | 2.6473830 | 477            | 2.6785184 |
| 412            | 2.6148972 | 445            | 2.6483600 | 478            | 2.6794279 |
| 413            | 2.6159501 | 446            | 2.6493349 | 479            | 2.6803355 |
| 414            | 2.6170003 | 447            | 2.6503075 | 480            | 2.6812412 |
| 415            | 2.6180481 | 448            | 2.6512780 | 481            | 2.6821451 |
| 416            | 2.6190933 | 449            | 2.6522463 | 482            | 2.6830470 |
| 417            | 2.6201361 | 450            | 2.6532125 | 483            | 2.6839471 |
| 418            | 2.6211763 | 451            | 2.6541765 | 484            | 2.6848454 |
| 419            | 2.6222140 | 452            | 2.6551384 | 485            | 2.6857417 |
| 420            | 2.6232493 | 453            | 2.6560982 | 486            | 2.6866363 |
| 421            | 2.6242821 | 454            | 2.6570559 | 487            | 2.6875290 |
| 422            | 2.6253125 | 455            | 2.6580114 | 488            | 2.6884198 |
| 423            | 2.6263404 | 456            | 2.6589648 | 489            | 2.6893089 |
| 424            | 2.6273659 | 457            | 2.6599162 | 490            | 2.6901961 |
| 425            | 2.6283889 | 458            | 2.6608655 | 491            | 2.6910815 |
| 426            | 2.6294096 | 459            | 2.6618127 | 492            | 2.6919651 |
| 427            | 2.6304279 | 460            | 2.6627578 | 493            | 2.6928469 |
| 428            | 2.6314438 | 461            | 2.6637009 | 494            | 2.6937269 |
| 429            | 2.6324573 | 462            | 2.6646420 | 495            | 2.6946052 |
| 430            | 2.6334685 | 463            | 2.6655810 | 496            | 2.6954817 |
| 431            | 2.6344773 | 464            | 2.6665180 | 497            | 2.6963564 |
| 432            | 2.6354837 | 465            | 2.6674530 | 498            | 2.6972293 |
| 433            | 2.6364879 | 466            | 2.6683859 | 499            | 2.6981005 |
| 434            | 2.6374897 | 467            | 2.6693169 | 500            | 2.6989700 |



# 500 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 501            | 2.6998377 | 534            | 2.7275413 | 567            | 2.7535831 |
| 502            | 2.7007037 | 535            | 2.7283538 | 568            | 2.7543483 |
| 503            | 2.7015680 | 536            | 2.7291648 | 569            | 2.7551123 |
| 504            | 2.7024305 | 537            | 2.7299743 | 570            | 2.7558749 |
| 505            | 2.7032914 | 538            | 2.7307823 | 571            | 2.7566361 |
| 506            | 2.7041505 | 539            | 2.7315888 | 572            | 2.7573960 |
| 507            | 2.7050080 | 540            | 2.7323938 | 573            | 2.7581546 |
| 508            | 2.7058637 | 541            | 2.7331973 | 574            | 2.7589119 |
| 509            | 2.7067178 | 542            | 2.7339993 | 575            | 2.7596678 |
| 510            | 2.7075702 | 543            | 2.7347998 | 576            | 2.7604225 |
| 511            | 2.7084209 | 544            | 2.7355989 | 577            | 2.7611758 |
| 512            | 2.7092700 | 545            | 2.7363965 | 578            | 2.7619278 |
| 513            | 2.7101174 | 546            | 2.7371926 | 579            | 2.7626786 |
| 514            | 2.7109631 | 547            | 2.7379873 | 580            | 2.7634280 |
| 515            | 2.7118072 | 548            | 2.7387806 | 581            | 2.7641761 |
| 516            | 2.7126497 | 549            | 2.7395723 | 582            | 2.7649230 |
| 517            | 2.7134905 | 550            | 2.7403627 | 583            | 2.7656686 |
| 518            | 2.7143298 | 551            | 2.7411516 | 584            | 2.7664128 |
| 519            | 2.7151674 | 552            | 2.7419391 | 585            | 2.7671559 |
| 520            | 2.7160033 | 553            | 2.7427251 | 586            | 2.7678976 |
| 521            | 2.7168377 | 554            | 2.7435098 | 587            | 2.7686381 |
| 522            | 2.7176705 | 555            | 2.7442930 | 588            | 2.7693773 |
| 523            | 2.7185017 | 556            | 2.7450748 | 589            | 2.7701153 |
| 524            | 2.7193313 | 557            | 2.7458552 | 590            | 2.7708520 |
| 525            | 2.7201593 | 558            | 2.7466342 | 591            | 2.7715875 |
| 526            | 2.7209857 | 559            | 2.7474118 | 592            | 2.7723217 |
| 527            | 2.7218106 | 560            | 2.7481880 | 593            | 2.7730547 |
| 528            | 2.7226339 | 561            | 2.7489629 | 594            | 2.7737864 |
| 529            | 2.7234557 | 562            | 2.7497363 | 595            | 2.7745170 |
| 530            | 2.7242759 | 563            | 2.7505084 | 596            | 2.7752463 |
| 531            | 2.7250945 | 564            | 2.7512791 | 597            | 2.7759743 |
| 532            | 2.7259116 | 565            | 2.7520484 | 598            | 2.7767012 |
| 533            | 2.7267272 | 566            | 2.7528164 | 599            | 2.7774268 |
| 534            | 2.7275413 | 567            | 2.7535831 | 600            | 2.7781513 |

# 600 A TABLE of LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 601            | 2.7788745 | 634            | 2.8020893 | 667            | 2.8241258 |
| 602            | 2.7795965 | 635            | 2.8027737 | 668            | 2.8247765 |
| 603            | 2.7803173 | 636            | 2.8034571 | 669            | 2.8254261 |
| 604            | 2.7810369 | 637            | 2.8041394 | 670            | 2.8260748 |
| 605            | 2.7817554 | 638            | 2.8048207 | 671            | 2.8267225 |
| 606            | 2.7824726 | 639            | 2.8055009 | 672            | 2.8273693 |
| 607            | 2.7831887 | 640            | 2.8061800 | 673            | 2.8280151 |
| 608            | 2.7839036 | 641            | 2.8068580 | 674            | 2.8286599 |
| 609            | 2.7846173 | 642            | 2.8075350 | 675            | 2.8293038 |
| 610            | 2.7853298 | 643            | 2.8082110 | 676            | 2.8299467 |
| 611            | 2.7860412 | 644            | 2.8088859 | 677            | 2.8305887 |
| 612            | 2.7867514 | 645            | 2.8095597 | 678            | 2.8312297 |
| 613            | 2.7874605 | 646            | 2.8102325 | 679            | 2.8318698 |
| 614            | 2.7881684 | 647            | 2.8109043 | 680            | 2.8325089 |
| 615            | 2.7888751 | 648            | 2.8115750 | 681            | 2.8331471 |
| 616            | 2.7895807 | 649            | 2.8122447 | 682            | 2.8337844 |
| 617            | 2.7902852 | 650            | 2.8129134 | 683            | 2.8344207 |
| 618            | 2.7909885 | 651            | 2.8135810 | 684            | 2.8350561 |
| 619            | 2.7916906 | 652            | 2.8142476 | 685            | 2.8356906 |
| 620            | 2.7923917 | 653            | 2.8149132 | 686            | 2.8363241 |
| 621            | 2.7930916 | 654            | 2.8155777 | 687            | 2.8369567 |
| 622            | 2.7937904 | 655            | 2.8162413 | 688            | 2.8375884 |
| 623            | 2.7944880 | 656            | 2.8169038 | 689            | 2.8382192 |
| 624            | 2.7951846 | 657            | 2.8175654 | 690            | 2.8388491 |
| 625            | 2.7958800 | 658            | 2.8182259 | 691            | 2.8394780 |
| 626            | 2.7965743 | 659            | 2.8188854 | 692            | 2.8401061 |
| 627            | 2.7972675 | 660            | 2.8195439 | 693            | 2.8407332 |
| 628            | 2.7979596 | 661            | 2.8202015 | 694            | 2.8413595 |
| 629            | 2.7986506 | 662            | 2.8208580 | 695            | 2.8419848 |
| 630            | 2.7993405 | 663            | 2.8215135 | 696            | 2.8426092 |
| 631            | 2.8000294 | 664            | 2.8221681 | 697            | 2.8432328 |
| 632            | 2.8007171 | 665            | 2.8228216 | 698            | 2.8438554 |
| 633            | 2.8014037 | 666            | 2.8234742 | 699            | 2.8444772 |
| 634            | 2.8020893 | 667            | 2.8241258 | 700            | 2.8450980 |

# 700 A TABLE OF LOGARITHMS. 000

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 701            | 2.8457180 | 734            | 2.8656961 | 767            | 2.8847954 |
| 702            | 2.8463371 | 735            | 2.8662873 | 768            | 2.8853612 |
| 703            | 2.8469553 | 736            | 2.8668778 | 769            | 2.8859263 |
| 704            | 2.8475727 | 737            | 2.8674675 | 770            | 2.8864907 |
| 705            | 2.8481891 | 738            | 2.8680564 | 771            | 2.8870544 |
| 706            | 2.8488047 | 739            | 2.8686444 | 772            | 2.8876173 |
| 707            | 2.8494194 | 740            | 2.8692317 | 773            | 2.8881795 |
| 708            | 2.8500333 | 741            | 2.8698182 | 774            | 2.8887410 |
| 709            | 2.8506462 | 742            | 2.8704039 | 775            | 2.8893017 |
| 710            | 2.8512583 | 743            | 2.8709888 | 776            | 2.8898617 |
| 711            | 2.8518696 | 744            | 2.8715729 | 777            | 2.8904210 |
| 712            | 2.8524800 | 745            | 2.8721563 | 778            | 2.8909796 |
| 713            | 2.8530895 | 746            | 2.8727388 | 779            | 2.8915375 |
| 714            | 2.8536982 | 747            | 2.8733206 | 780            | 2.8920946 |
| 715            | 2.8543065 | 748            | 2.8739016 | 781            | 2.8926510 |
| 716            | 2.8549130 | 749            | 2.8744818 | 782            | 2.8932068 |
| 717            | 2.8555192 | 750            | 2.8750613 | 783            | 2.8937618 |
| 718            | 2.8561244 | 751            | 2.8756399 | 784            | 2.8943161 |
| 719            | 2.8567289 | 752            | 2.8762178 | 785            | 2.8948697 |
| 720            | 2.8573325 | 753            | 2.8767950 | 786            | 2.8954225 |
| 721            | 2.8579353 | 754            | 2.8773713 | 787            | 2.8959747 |
| 722            | 2.8585372 | 755            | 2.8779470 | 788            | 2.8965262 |
| 723            | 2.8591383 | 756            | 2.8785218 | 789            | 2.8970770 |
| 724            | 2.8597386 | 757            | 2.8790959 | 790            | 2.8976271 |
| 725            | 2.8603380 | 758            | 2.8796692 | 791            | 2.8981765 |
| 726            | 2.8609360 | 759            | 2.8802418 | 792            | 2.8987252 |
| 727            | 2.8615344 | 760            | 2.8808136 | 793            | 2.8992732 |
| 728            | 2.8621314 | 761            | 2.8813847 | 794            | 2.8998205 |
| 729            | 2.8627275 | 762            | 2.8819550 | 795            | 2.9003671 |
| 730            | 2.8633229 | 763            | 2.8825245 | 796            | 2.9009131 |
| 731            | 2.8639174 | 764            | 2.8830934 | 797            | 2.9014583 |
| 732            | 2.8645111 | 765            | 2.8836614 | 798            | 2.9020029 |
| 733            | 2.8651040 | 766            | 2.8842288 | 799            | 2.9025468 |
| 734            | 2.8656961 | 767            | 2.8847954 | 800            | 2.9030900 |



# 800 A TABLE OF LOGARITHMS.

| N <sup>o</sup> . | Logarith. | N <sup>o</sup> . | Logarith. | N <sup>o</sup> . | Logarith. |
|------------------|-----------|------------------|-----------|------------------|-----------|
| 801              | 2.9036325 | 834              | 2.9211661 | 867              | 2.9380191 |
| 802              | 2.9041744 | 835              | 2.9216865 | 868              | 2.9385197 |
| 803              | 2.9047155 | 836              | 2.9222063 | 869              | 2.9390198 |
| 804              | 2.9052560 | 837              | 2.9227255 | 870              | 2.9395193 |
| 805              | 2.9057959 | 838              | 2.9232440 | 871              | 2.9400182 |
| 806              | 2.9063350 | 839              | 2.9237620 | 872              | 2.9405165 |
| 807              | 2.9068735 | 840              | 2.9242793 | 873              | 2.9410142 |
| 808              | 2.9074114 | 841              | 2.9247960 | 874              | 2.9415114 |
| 809              | 2.9079485 | 842              | 2.9253121 | 875              | 2.9420081 |
| 810              | 2.9084850 | 843              | 2.9258276 | 876              | 2.9425041 |
| 811              | 2.9090209 | 844              | 2.9263424 | 877              | 2.9429996 |
| 812              | 2.9095560 | 845              | 2.9268567 | 878              | 2.9434945 |
| 813              | 2.9100905 | 846              | 2.9273704 | 879              | 2.9439889 |
| 814              | 2.9106244 | 847              | 2.9278834 | 880              | 2.9444827 |
| 815              | 2.9111576 | 848              | 2.9283959 | 881              | 2.9449759 |
| 816              | 2.9116902 | 849              | 2.9289077 | 882              | 2.9454686 |
| 817              | 2.9122221 | 850              | 2.9294189 | 883              | 2.9459607 |
| 818              | 2.9127533 | 851              | 2.9299296 | 884              | 2.9464523 |
| 819              | 2.9132839 | 852              | 2.9304396 | 885              | 2.9469433 |
| 820              | 2.9138139 | 853              | 2.9309490 | 886              | 2.9474337 |
| 821              | 2.9143432 | 854              | 2.9314579 | 887              | 2.9479236 |
| 822              | 2.9148718 | 855              | 2.9319661 | 888              | 2.9484130 |
| 823              | 2.9153998 | 856              | 2.9324738 | 889              | 2.9489018 |
| 824              | 2.9159272 | 857              | 2.9329808 | 890              | 2.9493900 |
| 825              | 2.9164539 | 858              | 2.9334873 | 891              | 2.9498777 |
| 826              | 2.9169800 | 859              | 2.9339932 | 892              | 2.9503649 |
| 827              | 2.9175055 | 860              | 2.9344985 | 893              | 2.9508515 |
| 828              | 2.9180303 | 861              | 2.9350032 | 894              | 2.9513375 |
| 829              | 2.9185545 | 862              | 2.9355073 | 895              | 2.9518230 |
| 830              | 2.9190781 | 863              | 2.9360108 | 896              | 2.9523080 |
| 831              | 2.9196010 | 864              | 2.9365137 | 897              | 2.9527924 |
| 832              | 2.9201233 | 865              | 2.9370161 | 898              | 2.9532763 |
| 833              | 2.9206450 | 866              | 2.9375179 | 899              | 2.9537597 |
| 834              | 2.9211661 | 867              | 2.9380191 | 900              | 2.9542425 |

900 A TABLE OF LOGARITHMS. 000

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 901            | 2.9547248 | 934            | 2.9703469 | 967            | 2.9854265 |
| 902            | 2.9552065 | 935            | 2.9708116 | 968            | 2.9858754 |
| 903            | 2.9556878 | 936            | 2.9712758 | 969            | 2.9863238 |
| 904            | 2.9561684 | 937            | 2.9717396 | 970            | 2.9867717 |
| 905            | 2.9566486 | 938            | 2.9722028 | 971            | 2.9872192 |
| 906            | 2.9571282 | 939            | 2.9726656 | 972            | 2.9876663 |
| 907            | 2.9576073 | 940            | 2.9731279 | 973            | 2.9881128 |
| 908            | 2.9580858 | 941            | 2.9735896 | 974            | 2.9885590 |
| 909            | 2.9585639 | 942            | 2.9740509 | 975            | 2.9890046 |
| 910            | 2.9590414 | 943            | 2.9745117 | 976            | 2.9894498 |
| 911            | 2.9595184 | 944            | 2.9749720 | 977            | 2.9898946 |
| 912            | 2.9599948 | 945            | 2.9754318 | 978            | 2.9903389 |
| 913            | 2.9604708 | 946            | 2.9758911 | 979            | 2.9907827 |
| 914            | 2.9609462 | 947            | 2.9763500 | 980            | 2.9912261 |
| 915            | 2.9614211 | 948            | 2.9768083 | 981            | 2.9916690 |
| 916            | 2.9618955 | 949            | 2.9772662 | 982            | 2.9921115 |
| 917            | 2.9623693 | 950            | 2.9777236 | 983            | 2.9925535 |
| 918            | 2.9628427 | 951            | 2.9781805 | 984            | 2.9929951 |
| 919            | 2.9633155 | 952            | 2.9786369 | 985            | 2.9934362 |
| 920            | 2.9637878 | 953            | 2.9790929 | 986            | 2.9938769 |
| 921            | 2.9642596 | 954            | 2.9795484 | 987            | 2.9943172 |
| 922            | 2.9647309 | 955            | 2.9800034 | 988            | 2.9947569 |
| 923            | 2.9652017 | 956            | 2.9804579 | 989            | 2.9951963 |
| 924            | 2.9656720 | 957            | 2.9809119 | 990            | 2.9956352 |
| 925            | 2.9661417 | 958            | 2.9813655 | 991            | 2.9960737 |
| 926            | 2.9666110 | 959            | 2.9818186 | 992            | 2.9965117 |
| 927            | 2.9670797 | 960            | 2.9822712 | 993            | 2.9969492 |
| 928            | 2.9675480 | 961            | 2.9827234 | 994            | 2.9973864 |
| 929            | 2.9680157 | 962            | 2.9831751 | 995            | 2.9978231 |
| 930            | 2.9684829 | 963            | 2.9836263 | 996            | 2.9982593 |
| 931            | 2.9689497 | 964            | 2.9840770 | 997            | 2.9986952 |
| 932            | 2.9694159 | 965            | 2.9845273 | 998            | 2.9991305 |
| 933            | 2.9698816 | 966            | 2.9849771 | 999            | 2.9995655 |
| 934            | 2.9703469 | 967            | 2.9854265 | 1000           | 3.0000000 |

# 1000 A TABLE of LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 1001           | 3.0004341 | 1034           | 3.0145205 | 1067           | 3.0281644 |
| 1002           | 3.0008677 | 1035           | 3.0149403 | 1068           | 3.0285713 |
| 1003           | 3.0013009 | 1036           | 3.0153598 | 1069           | 3.0289777 |
| 1004           | 3.0017337 | 1037           | 3.0157788 | 1070           | 3.0293838 |
| 1005           | 3.0021661 | 1038           | 3.0161974 | 1071           | 3.0297895 |
| 1006           | 3.0025980 | 1039           | 3.0166155 | 1072           | 3.0301948 |
| 1007           | 3.0030295 | 1040           | 3.0170333 | 1073           | 3.0305997 |
| 1008           | 3.0034605 | 1041           | 3.0174507 | 1074           | 3.0310043 |
| 1009           | 3.0038912 | 1042           | 3.0178677 | 1075           | 3.0314085 |
| 1010           | 3.0043214 | 1043           | 3.0182843 | 1076           | 3.0318123 |
| 1011           | 3.0047512 | 1044           | 3.0187005 | 1077           | 3.0322157 |
| 1012           | 3.0051805 | 1045           | 3.0191163 | 1078           | 3.0326188 |
| 1013           | 3.0056094 | 1046           | 3.0195317 | 1079           | 3.0330214 |
| 1014           | 3.0060380 | 1047           | 3.0199467 | 1080           | 3.0334238 |
| 1015           | 3.0064660 | 1048           | 3.0203613 | 1081           | 3.0338257 |
| 1016           | 3.0068937 | 1049           | 3.0207755 | 1082           | 3.0342273 |
| 1017           | 3.0073210 | 1050           | 3.0211893 | 1083           | 3.0346285 |
| 1018           | 3.0077478 | 1051           | 3.0216027 | 1084           | 3.0350293 |
| 1019           | 3.0081742 | 1052           | 3.0220157 | 1085           | 3.0354297 |
| 1020           | 3.0086002 | 1053           | 3.0224284 | 1086           | 3.0358298 |
| 1021           | 3.0090257 | 1054           | 3.0228406 | 1087           | 3.0362295 |
| 1022           | 3.0094509 | 1055           | 3.0232525 | 1088           | 3.0366289 |
| 1023           | 3.0098756 | 1056           | 3.0236639 | 1089           | 3.0370279 |
| 1024           | 3.0103000 | 1057           | 3.0240750 | 1090           | 3.0374265 |
| 1025           | 3.0107239 | 1058           | 3.0244857 | 1091           | 3.0378248 |
| 1026           | 3.0111474 | 1059           | 3.0248960 | 1092           | 3.0382226 |
| 1027           | 3.0115704 | 1060           | 3.0253059 | 1093           | 3.0386202 |
| 1028           | 3.0119931 | 1061           | 3.0257154 | 1094           | 3.0390173 |
| 1029           | 3.0124154 | 1062           | 3.0261245 | 1095           | 3.0394141 |
| 1030           | 3.0128372 | 1063           | 3.0265332 | 1096           | 3.0398106 |
| 1031           | 3.0132587 | 1064           | 3.0269416 | 1097           | 3.0402066 |
| 1032           | 3.0136797 | 1065           | 3.0273496 | 1098           | 3.0406023 |
| 1033           | 3.0141003 | 1066           | 3.0277572 | 1099           | 3.0409977 |
| 1034           | 3.0145205 | 1067           | 3.0281644 | 1100           | 3.0413927 |



# 1100 A TABLE OF LOGARITHMS. 0001

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 1101           | 3.0417873 | 1134           | 3.0546131 | 1167           | 3.0670709 |
| 1102           | 3.0421816 | 1135           | 3.0549959 | 1168           | 3.0674428 |
| 1103           | 3.0425755 | 1136           | 3.0553783 | 1169           | 3.0678145 |
| 1104           | 3.0429691 | 1137           | 3.0557605 | 1170           | 3.0681859 |
| 1105           | 3.0433623 | 1138           | 3.0561423 | 1171           | 3.0685569 |
| 1106           | 3.0437551 | 1139           | 3.0565237 | 1172           | 3.0689276 |
| 1107           | 3.0441476 | 1140           | 3.0569049 | 1173           | 3.0692980 |
| 1108           | 3.0445398 | 1141           | 3.0572856 | 1174           | 3.0696681 |
| 1109           | 3.0449315 | 1142           | 3.0576661 | 1175           | 3.0700379 |
| 1110           | 3.0453230 | 1143           | 3.0580462 | 1176           | 3.0704073 |
| 1111           | 3.0457141 | 1144           | 3.0584260 | 1177           | 3.0707765 |
| 1112           | 3.0461048 | 1145           | 3.0588053 | 1178           | 3.0711453 |
| 1113           | 3.0464952 | 1146           | 3.0591846 | 1179           | 3.0715138 |
| 1114           | 3.0468852 | 1147           | 3.0595634 | 1180           | 3.0718820 |
| 1115           | 3.0472749 | 1148           | 3.0599419 | 1181           | 3.0722499 |
| 1116           | 3.0476642 | 1149           | 3.0603200 | 1182           | 3.0726175 |
| 1117           | 3.0480532 | 1150           | 3.0606978 | 1183           | 3.0729847 |
| 1118           | 3.0484418 | 1151           | 3.0610751 | 1184           | 3.0733517 |
| 1119           | 3.0488301 | 1152           | 3.0614525 | 1185           | 3.0737184 |
| 1120           | 3.0492180 | 1153           | 3.0618293 | 1186           | 3.0740847 |
| 1121           | 3.0496056 | 1154           | 3.0622058 | 1187           | 3.0744507 |
| 1122           | 3.0499929 | 1155           | 3.0625820 | 1188           | 3.0748164 |
| 1123           | 3.0503798 | 1156           | 3.0629578 | 1189           | 3.0751819 |
| 1124           | 3.0507663 | 1157           | 3.0633334 | 1190           | 3.0755470 |
| 1125           | 3.0511525 | 1158           | 3.0637086 | 1191           | 3.0759118 |
| 1126           | 3.0515384 | 1159           | 3.0640834 | 1192           | 3.0762763 |
| 1127           | 3.0519239 | 1160           | 3.0644580 | 1193           | 3.0766404 |
| 1128           | 3.0523091 | 1161           | 3.0648322 | 1194           | 3.0770043 |
| 1129           | 3.0526939 | 1162           | 3.0652061 | 1195           | 3.0773679 |
| 1130           | 3.0530784 | 1163           | 3.0655797 | 1196           | 3.0777312 |
| 1131           | 3.0534626 | 1164           | 3.0659530 | 1197           | 3.0780942 |
| 1132           | 3.0538464 | 1165           | 3.0663259 | 1198           | 3.0784568 |
| 1133           | 3.0542299 | 1166           | 3.0666986 | 1199           | 3.0788192 |
| 1134           | 3.0546131 | 1167           | 3.0670709 | 1200           | 3.0791812 |

# 1200 A TABLE OF LOGARITHMS 0021

| N <sup>o</sup> | Logarithm. | N <sup>o</sup> | Logarithm. | N <sup>o</sup> | Logarithm. |
|----------------|------------|----------------|------------|----------------|------------|
| 1201           | 3.0795430  | 1234           | 3.0913152  | 1267           | 3.1047766  |
| 1202           | 3.0799045  | 1235           | 3.0916670  | 1268           | 3.1051284  |
| 1203           | 3.0802656  | 1236           | 3.0920185  | 1269           | 3.1054801  |
| 1204           | 3.0806265  | 1237           | 3.0923697  | 1270           | 3.1058317  |
| 1205           | 3.0809870  | 1238           | 3.0927206  | 1271           | 3.1061832  |
| 1206           | 3.0813473  | 1239           | 3.0930713  | 1272           | 3.1065347  |
| 1207           | 3.0817073  | 1240           | 3.0934217  | 1273           | 3.1068861  |
| 1208           | 3.0820669  | 1241           | 3.0937718  | 1274           | 3.1072375  |
| 1209           | 3.0824263  | 1242           | 3.0941216  | 1275           | 3.1075888  |
| 1210           | 3.0827854  | 1243           | 3.0944711  | 1276           | 3.1079400  |
| 1211           | 3.0831441  | 1244           | 3.0948204  | 1277           | 3.1082911  |
| 1212           | 3.0835026  | 1245           | 3.0951694  | 1278           | 3.1086421  |
| 1213           | 3.0838608  | 1246           | 3.0955180  | 1279           | 3.1089930  |
| 1214           | 3.0842187  | 1247           | 3.0958665  | 1280           | 3.1093438  |
| 1215           | 3.0845763  | 1248           | 3.0962146  | 1281           | 3.1096945  |
| 1216           | 3.0849336  | 1249           | 3.0965624  | 1282           | 3.1100451  |
| 1217           | 3.0852906  | 1250           | 3.0969100  | 1283           | 3.1103956  |
| 1218           | 3.0856473  | 1251           | 3.0972573  | 1284           | 3.1107460  |
| 1219           | 3.0860037  | 1252           | 3.0976043  | 1285           | 3.1110963  |
| 1220           | 3.0863598  | 1253           | 3.0979511  | 1286           | 3.1114465  |
| 1221           | 3.0867157  | 1254           | 3.0982975  | 1287           | 3.1117966  |
| 1222           | 3.0870712  | 1255           | 3.0986437  | 1288           | 3.1121466  |
| 1223           | 3.0874265  | 1256           | 3.0989896  | 1289           | 3.1124965  |
| 1224           | 3.0877814  | 1257           | 3.0993353  | 1290           | 3.1128463  |
| 1225           | 3.0881361  | 1258           | 3.0996806  | 1291           | 3.1131960  |
| 1226           | 3.0884905  | 1259           | 3.1000257  | 1292           | 3.1135456  |
| 1227           | 3.0888446  | 1260           | 3.1003705  | 1293           | 3.1138951  |
| 1228           | 3.0891984  | 1261           | 3.1007151  | 1294           | 3.1142445  |
| 1229           | 3.0895519  | 1262           | 3.1010594  | 1295           | 3.1145938  |
| 1230           | 3.0899051  | 1263           | 3.1014034  | 1296           | 3.1149430  |
| 1231           | 3.0902581  | 1264           | 3.1017471  | 1297           | 3.1152921  |
| 1232           | 3.0906107  | 1265           | 3.1020905  | 1298           | 3.1156411  |
| 1233           | 3.0909631  | 1266           | 3.1024337  | 1299           | 3.1159900  |
| 1234           | 3.0913152  | 1267           | 3.1027766  | 1300           | 3.1163388  |

# 1300 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 1301           | 3.1142773 | 1334           | 3.1251558 | 1367           | 3.1357685 |
| 1302           | 3.1146110 | 1335           | 3.1254813 | 1368           | 3.1360861 |
| 1303           | 3.1149444 | 1336           | 3.1258065 | 1369           | 3.1364034 |
| 1304           | 3.1152776 | 1337           | 3.1261314 | 1370           | 3.1367206 |
| 1305           | 3.1156105 | 1338           | 3.1264561 | 1371           | 3.1370375 |
| 1306           | 3.1159432 | 1339           | 3.1267806 | 1372           | 3.1373541 |
| 1307           | 3.1162756 | 1340           | 3.1271048 | 1373           | 3.1376705 |
| 1308           | 3.1166077 | 1341           | 3.1274288 | 1374           | 3.1379867 |
| 1309           | 3.1169396 | 1342           | 3.1277525 | 1375           | 3.1383027 |
| 1310           | 3.1172713 | 1343           | 3.1280760 | 1376           | 3.1386184 |
| 1311           | 3.1176027 | 1344           | 3.1283993 | 1377           | 3.1389339 |
| 1312           | 3.1179338 | 1345           | 3.1287223 | 1378           | 3.1392492 |
| 1313           | 3.1182647 | 1346           | 3.1290451 | 1379           | 3.1395643 |
| 1314           | 3.1185954 | 1347           | 3.1293676 | 1380           | 3.1398791 |
| 1315           | 3.1189258 | 1348           | 3.1296899 | 1381           | 3.1401937 |
| 1316           | 3.1192559 | 1349           | 3.1300119 | 1382           | 3.1405080 |
| 1317           | 3.1195858 | 1350           | 3.1303338 | 1383           | 3.1408222 |
| 1318           | 3.1199154 | 1351           | 3.1306553 | 1384           | 3.1411361 |
| 1319           | 3.1202448 | 1352           | 3.1309769 | 1385           | 3.1414498 |
| 1320           | 3.1205739 | 1353           | 3.1312978 | 1386           | 3.1417631 |
| 1321           | 3.1209028 | 1354           | 3.1316187 | 1387           | 3.1420768 |
| 1322           | 3.1212315 | 1355           | 3.1319395 | 1388           | 3.1423895 |
| 1323           | 3.1215598 | 1356           | 3.1322597 | 1389           | 3.1427022 |
| 1324           | 3.1218880 | 1357           | 3.1325798 | 1390           | 3.1430148 |
| 1325           | 3.1222159 | 1358           | 3.1328998 | 1391           | 3.1433271 |
| 1326           | 3.1225435 | 1359           | 3.1332195 | 1392           | 3.1436392 |
| 1327           | 3.1228709 | 1360           | 3.1335389 | 1393           | 3.1439511 |
| 1328           | 3.1231981 | 1361           | 3.1338581 | 1394           | 3.1442628 |
| 1329           | 3.1235250 | 1362           | 3.1341771 | 1395           | 3.1445742 |
| 1330           | 3.1238516 | 1363           | 3.1344959 | 1396           | 3.1448854 |
| 1331           | 3.1241781 | 1364           | 3.1348144 | 1397           | 3.1451964 |
| 1332           | 3.1245042 | 1365           | 3.1351327 | 1398           | 3.1455072 |
| 1333           | 3.1248301 | 1366           | 3.1354507 | 1399           | 3.1458177 |
| 1334           | 3.1251558 | 1367           | 3.1357685 | 1400           | 3.1461280 |



# 1400. A TABLE OF LOGARITHMS. 001

| N <sup>o</sup> | Logarithm | N <sup>o</sup> | Logarithm | N <sup>o</sup> | Logarithm |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 1401           | 3.1464381 | 1434           | 3.1563492 | 1467           | 3.1664301 |
| 1402           | 3.1467480 | 1435           | 3.1568519 | 1468           | 3.1667260 |
| 1403           | 3.1470577 | 1436           | 3.1571544 | 1469           | 3.1670218 |
| 1404           | 3.1473671 | 1437           | 3.1574568 | 1470           | 3.1673173 |
| 1405           | 3.1476763 | 1438           | 3.1577589 | 1471           | 3.1676127 |
| 1406           | 3.1479853 | 1439           | 3.1580608 | 1472           | 3.1679078 |
| 1407           | 3.1482941 | 1440           | 3.1583625 | 1473           | 3.1682027 |
| 1408           | 3.1486027 | 1441           | 3.1586640 | 1474           | 3.1684975 |
| 1409           | 3.1489110 | 1442           | 3.1589653 | 1475           | 3.1687920 |
| 1410           | 3.1492191 | 1443           | 3.1592663 | 1476           | 3.1690864 |
| 1411           | 3.1495270 | 1444           | 3.1595672 | 1477           | 3.1693805 |
| 1412           | 3.1498347 | 1445           | 3.1598678 | 1478           | 3.1696744 |
| 1413           | 3.1501422 | 1446           | 3.1601683 | 1479           | 3.1699682 |
| 1414           | 3.1504494 | 1447           | 3.1604685 | 1480           | 3.1702617 |
| 1415           | 3.1507564 | 1448           | 3.1607686 | 1481           | 3.1705551 |
| 1416           | 3.1510633 | 1449           | 3.1610684 | 1482           | 3.1708482 |
| 1417           | 3.1513699 | 1450           | 3.1613680 | 1483           | 3.1711412 |
| 1418           | 3.1516762 | 1451           | 3.1616674 | 1484           | 3.1714339 |
| 1419           | 3.1519824 | 1452           | 3.1619666 | 1485           | 3.1717265 |
| 1420           | 3.1522881 | 1453           | 3.1622656 | 1486           | 3.1720188 |
| 1421           | 3.1525941 | 1454           | 3.1625644 | 1487           | 3.1723110 |
| 1422           | 3.1528996 | 1455           | 3.1628630 | 1488           | 3.1726029 |
| 1423           | 3.1532049 | 1456           | 3.1631614 | 1489           | 3.1728947 |
| 1424           | 3.1535100 | 1457           | 3.1634595 | 1490           | 3.1731863 |
| 1425           | 3.1538149 | 1458           | 3.1637575 | 1491           | 3.1734776 |
| 1426           | 3.1541195 | 1459           | 3.1640553 | 1492           | 3.1737688 |
| 1427           | 3.1544240 | 1460           | 3.1643529 | 1493           | 3.1740598 |
| 1428           | 3.1547282 | 1461           | 3.1646502 | 1494           | 3.1743506 |
| 1429           | 3.1550322 | 1462           | 3.1649474 | 1495           | 3.1746412 |
| 1430           | 3.1553360 | 1463           | 3.1652443 | 1496           | 3.1749316 |
| 1431           | 3.1556396 | 1464           | 3.1655411 | 1497           | 3.1752218 |
| 1432           | 3.1559430 | 1465           | 3.1658376 | 1498           | 3.1755118 |
| 1433           | 3.1562462 | 1466           | 3.1661340 | 1499           | 3.1758016 |
| 1434           | 3.1565492 | 1467           | 3.1664301 | 1500           | 3.1760913 |

# 1509. A TABLE OF LOGARITHMS.

| No.  | Logarith. | No.  | Logarith. | No.  | Logarith. |
|------|-----------|------|-----------|------|-----------|
| 1501 | 3.1761807 | 1534 | 3.1858254 | 1567 | 3.1950090 |
| 1502 | 3.1765699 | 1535 | 3.1861084 | 1568 | 3.1953461 |
| 1503 | 3.1769590 | 1536 | 3.1863912 | 1569 | 3.1956229 |
| 1504 | 3.1772478 | 1537 | 3.1866730 | 1570 | 3.1958997 |
| 1505 | 3.1775368 | 1538 | 3.1869563 | 1571 | 3.1961762 |
| 1506 | 3.1778250 | 1539 | 3.1872386 | 1572 | 3.1964525 |
| 1507 | 3.1781133 | 1540 | 3.1875207 | 1573 | 3.1967287 |
| 1508 | 3.1784013 | 1541 | 3.1878026 | 1574 | 3.1970047 |
| 1509 | 3.1786892 | 1542 | 3.1880844 | 1575 | 3.1972806 |
| 1510 | 3.1789767 | 1543 | 3.1883659 | 1576 | 3.1975562 |
| 1511 | 3.1792645 | 1544 | 3.1886473 | 1577 | 3.1978317 |
| 1512 | 3.1795518 | 1545 | 3.1889285 | 1578 | 3.1981070 |
| 1513 | 3.1798389 | 1546 | 3.1892095 | 1579 | 3.1983821 |
| 1514 | 3.1801259 | 1547 | 3.1894903 | 1580 | 3.1986571 |
| 1515 | 3.1804126 | 1548 | 3.1897710 | 1581 | 3.1989319 |
| 1516 | 3.1806992 | 1549 | 3.1900514 | 1582 | 3.1992065 |
| 1517 | 3.1809856 | 1550 | 3.1903317 | 1583 | 3.1994809 |
| 1518 | 3.1812718 | 1551 | 3.1906118 | 1584 | 3.1997552 |
| 1519 | 3.1815578 | 1552 | 3.1908917 | 1585 | 3.2000293 |
| 1520 | 3.1818436 | 1553 | 3.1911715 | 1586 | 3.2003032 |
| 1521 | 3.1821292 | 1554 | 3.1914510 | 1587 | 3.2005769 |
| 1522 | 3.1824147 | 1555 | 3.1917304 | 1588 | 3.2008505 |
| 1523 | 3.1826999 | 1556 | 3.1920096 | 1589 | 3.2011239 |
| 1524 | 3.1829850 | 1557 | 3.1922886 | 1590 | 3.2013971 |
| 1525 | 3.1832698 | 1558 | 3.1925675 | 1591 | 3.2016702 |
| 1526 | 3.1835545 | 1559 | 3.1928461 | 1592 | 3.2019431 |
| 1527 | 3.1838390 | 1560 | 3.1931246 | 1593 | 3.2022158 |
| 1528 | 3.1841234 | 1561 | 3.1934029 | 1594 | 3.2024883 |
| 1529 | 3.1844075 | 1562 | 3.1936810 | 1595 | 3.2027607 |
| 1530 | 3.1846914 | 1563 | 3.1939590 | 1596 | 3.2030329 |
| 1531 | 3.1849752 | 1564 | 3.1942367 | 1597 | 3.2033049 |
| 1532 | 3.1852588 | 1565 | 3.1945143 | 1598 | 3.2035768 |
| 1533 | 3.1855422 | 1566 | 3.1947918 | 1599 | 3.2038485 |
| 1534 | 3.1858254 | 1567 | 3.1950690 | 1600 | 3.2041200 |

# 1600 A TABLE OF LOGARITHMS. 001

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith.  |
|----------------|-----------|----------------|-----------|----------------|------------|
| 1601           | 3.2043913 | 1634           | 3.2132521 | 1667           | 3.22259356 |
| 1602           | 3.2046625 | 1635           | 3.2135178 | 1668           | 3.2228960  |
| 1603           | 3.2049335 | 1636           | 3.2137833 | 1669           | 3.2231985  |
| 1604           | 3.2052044 | 1637           | 3.2140487 | 1670           | 3.2235010  |
| 1605           | 3.2054750 | 1638           | 3.2143139 | 1671           | 3.2238035  |
| 1606           | 3.2057455 | 1639           | 3.2145790 | 1672           | 3.2241060  |
| 1607           | 3.2060159 | 1640           | 3.2148438 | 1673           | 3.2244085  |
| 1608           | 3.2062860 | 1641           | 3.2151086 | 1674           | 3.2247110  |
| 1609           | 3.2065560 | 1642           | 3.2153732 | 1675           | 3.2250135  |
| 1610           | 3.2068259 | 1643           | 3.2156376 | 1676           | 3.2253160  |
| 1611           | 3.2070955 | 1644           | 3.2159018 | 1677           | 3.2256185  |
| 1612           | 3.2073650 | 1645           | 3.2161659 | 1678           | 3.2259210  |
| 1613           | 3.2076344 | 1646           | 3.2164298 | 1679           | 3.2262235  |
| 1614           | 3.2079035 | 1647           | 3.2166936 | 1680           | 3.2265260  |
| 1615           | 3.2081725 | 1648           | 3.2169572 | 1681           | 3.2268285  |
| 1616           | 3.2084414 | 1649           | 3.2172207 | 1682           | 3.2271310  |
| 1617           | 3.2087100 | 1650           | 3.2174839 | 1683           | 3.2274335  |
| 1618           | 3.2089785 | 1651           | 3.2177471 | 1684           | 3.2277360  |
| 1619           | 3.2092468 | 1652           | 3.2180100 | 1685           | 3.2280385  |
| 1620           | 3.2095150 | 1653           | 3.2182729 | 1686           | 3.2283410  |
| 1621           | 3.2097830 | 1654           | 3.2185355 | 1687           | 3.2286435  |
| 1622           | 3.2100508 | 1655           | 3.2187980 | 1688           | 3.2289460  |
| 1623           | 3.2103185 | 1656           | 3.2190603 | 1689           | 3.2292485  |
| 1624           | 3.2105860 | 1657           | 3.2193225 | 1690           | 3.2295510  |
| 1625           | 3.2108534 | 1658           | 3.2195845 | 1691           | 3.2298535  |
| 1626           | 3.2111205 | 1659           | 3.2198464 | 1692           | 3.2301560  |
| 1627           | 3.2113876 | 1660           | 3.2201081 | 1693           | 3.2304585  |
| 1628           | 3.2116544 | 1661           | 3.2203696 | 1694           | 3.2307610  |
| 1629           | 3.2119211 | 1662           | 3.2206310 | 1695           | 3.2310635  |
| 1630           | 3.2121876 | 1663           | 3.2208922 | 1696           | 3.2313660  |
| 1631           | 3.2124540 | 1664           | 3.2211533 | 1697           | 3.2316685  |
| 1632           | 3.2127202 | 1665           | 3.2214142 | 1698           | 3.2319710  |
| 1633           | 3.2129862 | 1666           | 3.2216750 | 1699           | 3.2322735  |
| 1634           | 3.2132521 | 1667           | 3.2219356 | 1700           | 3.2325760  |



# 1700 A TABLE of LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 1701           | 3.2307043 | 1734           | 3.2390491 | 1767           | 3.2472365 |
| 1702           | 3.2309596 | 1735           | 3.2392995 | 1768           | 3.2474823 |
| 1703           | 3.2312146 | 1736           | 3.2395497 | 1769           | 3.2477278 |
| 1704           | 3.2314696 | 1737           | 3.2397998 | 1770           | 3.2479733 |
| 1705           | 3.2317244 | 1738           | 3.2400498 | 1771           | 3.2482186 |
| 1706           | 3.2319790 | 1739           | 3.2402996 | 1772           | 3.2484637 |
| 1707           | 3.2322335 | 1740           | 3.2405492 | 1773           | 3.2487087 |
| 1708           | 3.2324879 | 1741           | 3.2407988 | 1774           | 3.2489536 |
| 1709           | 3.2327421 | 1742           | 3.2410482 | 1775           | 3.2491984 |
| 1710           | 3.2329961 | 1743           | 3.2412974 | 1776           | 3.2494430 |
| 1711           | 3.2332500 | 1744           | 3.2415465 | 1777           | 3.2496874 |
| 1712           | 3.2335038 | 1745           | 3.2417954 | 1778           | 3.2499318 |
| 1713           | 3.2337574 | 1746           | 3.2420442 | 1779           | 3.2501759 |
| 1714           | 3.2340108 | 1747           | 3.2422929 | 1780           | 3.2504200 |
| 1715           | 3.2342641 | 1748           | 3.2425414 | 1781           | 3.2506639 |
| 1716           | 3.2345173 | 1749           | 3.2427898 | 1782           | 3.2509077 |
| 1717           | 3.2347703 | 1750           | 3.2430380 | 1783           | 3.2511513 |
| 1718           | 3.2350232 | 1751           | 3.2432861 | 1784           | 3.2513949 |
| 1719           | 3.2352759 | 1752           | 3.2435341 | 1785           | 3.2516382 |
| 1720           | 3.2355284 | 1753           | 3.2437819 | 1786           | 3.2518815 |
| 1721           | 3.2357809 | 1754           | 3.2440296 | 1787           | 3.2521246 |
| 1722           | 3.2360331 | 1755           | 3.2442771 | 1788           | 3.2523675 |
| 1723           | 3.2362853 | 1756           | 3.2445245 | 1789           | 3.2526103 |
| 1724           | 3.2365373 | 1757           | 3.2447718 | 1790           | 3.2528530 |
| 1725           | 3.2367891 | 1758           | 3.2450189 | 1791           | 3.2530956 |
| 1726           | 3.2370408 | 1759           | 3.2452658 | 1792           | 3.2533380 |
| 1727           | 3.2372923 | 1760           | 3.2455127 | 1793           | 3.2535803 |
| 1728           | 3.2375437 | 1761           | 3.2457594 | 1794           | 3.2538224 |
| 1729           | 3.2377950 | 1762           | 3.2460059 | 1795           | 3.2540645 |
| 1730           | 3.2380461 | 1763           | 3.2462523 | 1796           | 3.2543063 |
| 1731           | 3.2382971 | 1764           | 3.2464986 | 1797           | 3.2545481 |
| 1732           | 3.2385479 | 1765           | 3.2467447 | 1798           | 3.2547897 |
| 1733           | 3.2387986 | 1766           | 3.2469907 | 1799           | 3.2550312 |
| 1734           | 3.2390491 | 1767           | 3.2472365 | 1800           | 3.2552725 |

# 1800 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 1801           | 3.2555137 | 1831           | 3.2633993 | 1861           | 3.2711443 |
| 1802           | 3.2557548 | 1832           | 3.2636361 | 1862           | 3.2713769 |
| 1803           | 3.2559957 | 1833           | 3.2638727 | 1863           | 3.2716093 |
| 1804           | 3.2562369 | 1834           | 3.2641091 | 1864           | 3.2718416 |
| 1805           | 3.2564774 | 1835           | 3.2643455 | 1865           | 3.2720738 |
| 1806           | 3.2567177 | 1836           | 3.2645817 | 1866           | 3.2723058 |
| 1807           | 3.2569582 | 1837           | 3.2648178 | 1867           | 3.2725378 |
| 1808           | 3.2571984 | 1838           | 3.2650538 | 1868           | 3.2727696 |
| 1809           | 3.2574386 | 1839           | 3.2652896 | 1869           | 3.2729993 |
| 1810           | 3.2576786 | 1840           | 3.2655253 | 1870           | 3.2732288 |
| 1811           | 3.2579185 | 1841           | 3.2657609 | 1871           | 3.2734583 |
| 1812           | 3.2581582 | 1842           | 3.2659964 | 1872           | 3.2736878 |
| 1813           | 3.2583978 | 1843           | 3.2662317 | 1873           | 3.2739173 |
| 1814           | 3.2586373 | 1844           | 3.2664669 | 1874           | 3.2741468 |
| 1815           | 3.2588766 | 1845           | 3.2667020 | 1875           | 3.2743763 |
| 1816           | 3.2591158 | 1846           | 3.2669369 | 1876           | 3.2746058 |
| 1817           | 3.2593549 | 1847           | 3.2671717 | 1877           | 3.2748353 |
| 1818           | 3.2595939 | 1848           | 3.2674064 | 1878           | 3.2750648 |
| 1819           | 3.2598327 | 1849           | 3.2676410 | 1879           | 3.2752943 |
| 1820           | 3.2600714 | 1850           | 3.2678754 | 1880           | 3.2755238 |
| 1821           | 3.2603099 | 1851           | 3.2681097 | 1881           | 3.2757533 |
| 1822           | 3.2605484 | 1852           | 3.2683439 | 1882           | 3.2759828 |
| 1823           | 3.2607867 | 1853           | 3.2685780 | 1883           | 3.2762123 |
| 1824           | 3.2610248 | 1854           | 3.2688119 | 1884           | 3.2764418 |
| 1825           | 3.2612629 | 1855           | 3.2690457 | 1885           | 3.2766713 |
| 1826           | 3.2615008 | 1856           | 3.2692794 | 1886           | 3.2769008 |
| 1827           | 3.2617385 | 1857           | 3.2695129 | 1887           | 3.2771303 |
| 1828           | 3.2619762 | 1858           | 3.2697464 | 1888           | 3.2773598 |
| 1829           | 3.2622137 | 1859           | 3.2699797 | 1889           | 3.2775893 |
| 1830           | 3.2624511 | 1860           | 3.2702129 | 1890           | 3.2778188 |
| 1831           | 3.2626883 | 1861           | 3.2704459 | 1891           | 3.2780483 |
| 1832           | 3.2629255 | 1862           | 3.2706788 | 1892           | 3.2782778 |
| 1833           | 3.2631625 | 1863           | 3.2709116 | 1893           | 3.2785073 |
| 1834           | 3.2633993 | 1864           | 3.2711443 | 1894           | 3.2787368 |
|                |           |                |           | 1895           | 3.2789663 |
|                |           |                |           | 1896           | 3.2791958 |
|                |           |                |           | 1897           | 3.2794253 |
|                |           |                |           | 1898           | 3.2796548 |
|                |           |                |           | 1899           | 3.2798843 |
|                |           |                |           | 1900           | 3.2801138 |

# 1900 A TABLE OF LOGARITHMS. 0081

| N°   | Logarith. | N°   | Logarith. | N°   | Logarith. |
|------|-----------|------|-----------|------|-----------|
| 1901 | 3.2799821 | 1934 | 3.2864509 | 1967 | 3.2938074 |
| 1902 | 3.2792105 | 1935 | 3.2866810 | 1968 | 3.2940251 |
| 1903 | 3.2794388 | 1936 | 3.2869054 | 1969 | 3.2942457 |
| 1904 | 3.2796669 | 1937 | 3.2871290 | 1970 | 3.2944662 |
| 1905 | 3.2798950 | 1938 | 3.2873528 | 1971 | 3.2946866 |
| 1906 | 3.2801229 | 1939 | 3.2875778 | 1972 | 3.2949069 |
| 1907 | 3.2803507 | 1940 | 3.2878017 | 1973 | 3.2951271 |
| 1908 | 3.2805784 | 1941 | 3.2880255 | 1974 | 3.2953471 |
| 1909 | 3.2808059 | 1942 | 3.2882492 | 1975 | 3.2955671 |
| 1910 | 3.2810334 | 1943 | 3.2884728 | 1976 | 3.2957869 |
| 1911 | 3.2812607 | 1944 | 3.2886963 | 1977 | 3.2960067 |
| 1912 | 3.2814879 | 1945 | 3.2889190 | 1978 | 3.2962263 |
| 1913 | 3.2817150 | 1946 | 3.2891420 | 1979 | 3.2964458 |
| 1914 | 3.2819410 | 1947 | 3.2893660 | 1980 | 3.2966652 |
| 1915 | 3.2821688 | 1948 | 3.2895890 | 1981 | 3.2968845 |
| 1916 | 3.2823953 | 1949 | 3.2898118 | 1982 | 3.2971037 |
| 1917 | 3.2826221 | 1950 | 3.2900346 | 1983 | 3.2973227 |
| 1918 | 3.2828486 | 1951 | 3.2902573 | 1984 | 3.2975417 |
| 1919 | 3.2830750 | 1952 | 3.2904798 | 1985 | 3.2977609 |
| 1920 | 3.2833012 | 1953 | 3.2907022 | 1986 | 3.2979799 |
| 1921 | 3.2835274 | 1954 | 3.2909240 | 1987 | 3.2981979 |
| 1922 | 3.2837534 | 1955 | 3.2911468 | 1988 | 3.2984164 |
| 1923 | 3.2839793 | 1956 | 3.2913689 | 1989 | 3.2986348 |
| 1924 | 3.2842051 | 1957 | 3.2915908 | 1990 | 3.2988531 |
| 1925 | 3.2844307 | 1958 | 3.2918127 | 1991 | 3.2990711 |
| 1926 | 3.2846563 | 1959 | 3.2920344 | 1992 | 3.2992893 |
| 1927 | 3.2848817 | 1960 | 3.2922561 | 1993 | 3.2995073 |
| 1928 | 3.2851070 | 1961 | 3.2924775 | 1994 | 3.2997252 |
| 1929 | 3.2853322 | 1962 | 3.2926990 | 1995 | 3.2999429 |
| 1930 | 3.2855573 | 1963 | 3.2929208 | 1996 | 3.3001605 |
| 1931 | 3.2857823 | 1964 | 3.2931415 | 1997 | 3.3003788 |
| 1932 | 3.286007  | 1965 | 3.2933626 | 1998 | 3.3005955 |
| 1933 | 3.2862319 | 1966 | 3.2935835 | 1999 | 3.3008128 |
| 1934 | 3.2864565 | 1967 | 3.2938044 | 2000 | 3.3010300 |

2000



# 2000. A TABLE OF LOGARITHMS. CCIS

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 2001           | 3.3012471 | 2034           | 3.3083509 | 2067           | 3.3153405 |
| 2002           | 3.3014641 | 2035           | 3.3085644 | 2068           | 3.3155505 |
| 2003           | 3.3016809 | 2036           | 3.3087778 | 2069           | 3.3157605 |
| 2004           | 3.3018977 | 2037           | 3.3089910 | 2070           | 3.3159703 |
| 2005           | 3.3021144 | 2038           | 3.3092042 | 2071           | 3.3161801 |
| 2006           | 3.3023309 | 2039           | 3.3094172 | 2072           | 3.3163898 |
| 2007           | 3.3025474 | 2040           | 3.3096302 | 2073           | 3.3165993 |
| 2008           | 3.3027637 | 2041           | 3.3098420 | 2074           | 3.3168088 |
| 2009           | 3.3029799 | 2042           | 3.3100557 | 2075           | 3.3170181 |
| 2010           | 3.3031961 | 2043           | 3.3102684 | 2076           | 3.3172273 |
| 2011           | 3.3034121 | 2044           | 3.3104809 | 2077           | 3.3174365 |
| 2012           | 3.3036286 | 2045           | 3.3106932 | 2078           | 3.3176455 |
| 2013           | 3.3038438 | 2046           | 3.3109056 | 2079           | 3.3178545 |
| 2014           | 3.3040593 | 2047           | 3.3111178 | 2080           | 3.3180633 |
| 2015           | 3.3042751 | 2048           | 3.3113296 | 2081           | 3.3182721 |
| 2016           | 3.3044905 | 2049           | 3.3115420 | 2082           | 3.3184807 |
| 2017           | 3.3047059 | 2050           | 3.3117539 | 2083           | 3.3186893 |
| 2018           | 3.3049212 | 2051           | 3.3119657 | 2084           | 3.3188977 |
| 2019           | 3.3051363 | 2052           | 3.3121774 | 2085           | 3.3191061 |
| 2020           | 3.3053514 | 2053           | 3.3123889 | 2086           | 3.3193143 |
| 2021           | 3.3055663 | 2054           | 3.3126004 | 2087           | 3.3195224 |
| 2022           | 3.3057812 | 2055           | 3.3128118 | 2088           | 3.3197305 |
| 2023           | 3.3059959 | 2056           | 3.3130231 | 2089           | 3.3199384 |
| 2024           | 3.3062105 | 2057           | 3.3132343 | 2090           | 3.3201463 |
| 2025           | 3.3064250 | 2058           | 3.3134454 | 2091           | 3.3203540 |
| 2026           | 3.3066394 | 2059           | 3.3136563 | 2092           | 3.3205617 |
| 2027           | 3.3068537 | 2060           | 3.3138672 | 2093           | 3.3207692 |
| 2028           | 3.3070680 | 2061           | 3.3140780 | 2094           | 3.3209767 |
| 2029           | 3.3072826 | 2062           | 3.3142887 | 2095           | 3.3211840 |
| 2030           | 3.3074966 | 2063           | 3.3144992 | 2096           | 3.3213913 |
| 2031           | 3.3077099 | 2064           | 3.3147097 | 2097           | 3.3215984 |
| 2032           | 3.3079237 | 2065           | 3.3149201 | 2098           | 3.3218055 |
| 2033           | 3.3081374 | 2066           | 3.3151303 | 2099           | 3.3220124 |
| 2034           | 3.3083509 | 2067           | 3.3153405 | 2100           | 3.3222193 |

# 2100. A TABLE OF LOGARITHMS. 0000

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 2101           | 3.3224261 | 2134           | 3.3291944 | 2167           | 3.3358589 |
| 2102           | 3.3226327 | 2135           | 3.3293979 | 2168           | 3.3360593 |
| 2103           | 3.3228393 | 2136           | 3.3296012 | 2169           | 3.3362596 |
| 2104           | 3.3230457 | 2137           | 3.3298045 | 2170           | 3.3364597 |
| 2105           | 3.3232521 | 2138           | 3.3300077 | 2171           | 3.3366598 |
| 2106           | 3.3234584 | 2139           | 3.3302108 | 2172           | 3.3368598 |
| 2107           | 3.3236645 | 2140           | 3.3304138 | 2173           | 3.3370597 |
| 2108           | 3.3238708 | 2141           | 3.3306167 | 2174           | 3.3372595 |
| 2109           | 3.3240766 | 2142           | 3.3308195 | 2175           | 3.3374593 |
| 2110           | 3.3242825 | 2143           | 3.3310222 | 2176           | 3.3376589 |
| 2111           | 3.3244882 | 2144           | 3.3312248 | 2177           | 3.3378584 |
| 2112           | 3.3246939 | 2145           | 3.3314273 | 2178           | 3.3380579 |
| 2113           | 3.3248995 | 2146           | 3.3316297 | 2179           | 3.3382572 |
| 2114           | 3.3251050 | 2147           | 3.3318320 | 2180           | 3.3384565 |
| 2115           | 3.3253104 | 2148           | 3.3320343 | 2181           | 3.3386557 |
| 2116           | 3.3255157 | 2149           | 3.3322364 | 2182           | 3.3388547 |
| 2117           | 3.3257209 | 2150           | 3.3324385 | 2183           | 3.3390537 |
| 2118           | 3.3259260 | 2151           | 3.3326404 | 2184           | 3.3392526 |
| 2119           | 3.3261310 | 2152           | 3.3328423 | 2185           | 3.3394514 |
| 2120           | 3.3263359 | 2153           | 3.3330440 | 2186           | 3.3396502 |
| 2121           | 3.3265407 | 2154           | 3.3332457 | 2187           | 3.3398488 |
| 2122           | 3.3267454 | 2155           | 3.3334473 | 2188           | 3.3400473 |
| 2123           | 3.3269500 | 2156           | 3.3336488 | 2189           | 3.3402458 |
| 2124           | 3.3271545 | 2157           | 3.3338501 | 2190           | 3.3404441 |
| 2125           | 3.3273589 | 2158           | 3.3340514 | 2191           | 3.3406424 |
| 2126           | 3.3275633 | 2159           | 3.3342526 | 2192           | 3.3408405 |
| 2127           | 3.3277675 | 2160           | 3.3344538 | 2193           | 3.3410386 |
| 2128           | 3.3279716 | 2161           | 3.3346548 | 2194           | 3.3412366 |
| 2129           | 3.3281757 | 2162           | 3.3348557 | 2195           | 3.3414345 |
| 2130           | 3.3283796 | 2163           | 3.3350565 | 2196           | 3.3416323 |
| 2131           | 3.3285834 | 2164           | 3.3352573 | 2197           | 3.3418301 |
| 2132           | 3.3287872 | 2165           | 3.3354579 | 2198           | 3.3420277 |
| 2133           | 3.3289909 | 2166           | 3.3356585 | 2199           | 3.3422252 |
| 2134           | 3.3291944 | 2167           | 3.3358589 | 2200           | 3.3424227 |

# 2200 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 2201           | 3.3426200 | 2234           | 3.3490832 | 2267           | 3.3554515 |
| 2202           | 3.3428173 | 2235           | 3.3492775 | 2268           | 3.3556431 |
| 2203           | 3.3430145 | 2236           | 3.3494718 | 2269           | 3.3558345 |
| 2204           | 3.3432116 | 2237           | 3.3496660 | 2270           | 3.3560259 |
| 2205           | 3.3434086 | 2238           | 3.3498601 | 2271           | 3.3562171 |
| 2206           | 3.3436055 | 2239           | 3.3500541 | 2272           | 3.3564083 |
| 2207           | 3.3438023 | 2240           | 3.3502480 | 2273           | 3.3565994 |
| 2208           | 3.3439991 | 2241           | 3.3504419 | 2274           | 3.3567905 |
| 2209           | 3.3441957 | 2242           | 3.3506356 | 2275           | 3.3569814 |
| 2210           | 3.3443923 | 2243           | 3.3508293 | 2276           | 3.3571723 |
| 2211           | 3.3445887 | 2244           | 3.3510229 | 2277           | 3.3573630 |
| 2212           | 3.3447851 | 2245           | 3.3512163 | 2278           | 3.3575537 |
| 2213           | 3.3449814 | 2246           | 3.3514098 | 2279           | 3.3577443 |
| 2214           | 3.3451776 | 2247           | 3.3516031 | 2280           | 3.3579348 |
| 2215           | 3.3453737 | 2248           | 3.3517963 | 2281           | 3.3581253 |
| 2216           | 3.3455698 | 2249           | 3.3519895 | 2282           | 3.3583156 |
| 2217           | 3.3457657 | 2250           | 3.3521825 | 2283           | 3.3585059 |
| 2218           | 3.3459615 | 2251           | 3.3523755 | 2284           | 3.3586961 |
| 2219           | 3.3461573 | 2252           | 3.3525684 | 2285           | 3.3588862 |
| 2220           | 3.3463530 | 2253           | 3.3527612 | 2286           | 3.3590762 |
| 2221           | 3.3465486 | 2254           | 3.3529539 | 2287           | 3.3592662 |
| 2222           | 3.3467441 | 2255           | 3.3531465 | 2288           | 3.3594560 |
| 2223           | 3.3469395 | 2256           | 3.3533391 | 2289           | 3.3596458 |
| 2224           | 3.3471348 | 2257           | 3.3535316 | 2290           | 3.3598355 |
| 2225           | 3.3473300 | 2258           | 3.3537239 | 2291           | 3.3600251 |
| 2226           | 3.3475252 | 2259           | 3.3539162 | 2292           | 3.3602146 |
| 2227           | 3.3477202 | 2260           | 3.3541084 | 2293           | 3.3604041 |
| 2228           | 3.3479152 | 2261           | 3.3543006 | 2294           | 3.3605934 |
| 2229           | 3.3481101 | 2262           | 3.3544926 | 2295           | 3.3607827 |
| 2230           | 3.3483049 | 2263           | 3.3546846 | 2296           | 3.3609719 |
| 2231           | 3.3484996 | 2264           | 3.3548704 | 2297           | 3.3611610 |
| 2232           | 3.3486942 | 2265           | 3.3550682 | 2298           | 3.3613500 |
| 2233           | 3.3488887 | 2266           | 3.3552599 | 2299           | 3.3615390 |
| 2234           | 3.3490832 | 2267           | 3.3554515 | 2300           | 3.3617278 |



# 2300. A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 2301           | 3.3619166 | 2334           | 3.3681008 | 2367           | 3.3741983 |
| 2302           | 3.3621053 | 2335           | 3.3682869 | 2368           | 3.3743817 |
| 2303           | 3.3622939 | 2336           | 3.3684728 | 2369           | 3.3745651 |
| 2304           | 3.3624825 | 2337           | 3.3686587 | 2370           | 3.3747483 |
| 2305           | 3.3626709 | 2338           | 3.3688445 | 2371           | 3.3749316 |
| 2306           | 3.3628593 | 2339           | 3.3690302 | 2372           | 3.3751147 |
| 2307           | 3.3630476 | 2340           | 3.3692159 | 2373           | 3.3752977 |
| 2308           | 3.3632358 | 2341           | 3.3694014 | 2374           | 3.3754807 |
| 2309           | 3.3634239 | 2342           | 3.3695869 | 2375           | 3.3756636 |
| 2310           | 3.3636120 | 2343           | 3.3697723 | 2376           | 3.3758464 |
| 2311           | 3.3637999 | 2344           | 3.3699576 | 2377           | 3.3760292 |
| 2312           | 3.3639878 | 2345           | 3.3701428 | 2378           | 3.3762118 |
| 2313           | 3.3641756 | 2346           | 3.3703280 | 2379           | 3.3763944 |
| 2314           | 3.3643633 | 2347           | 3.3705131 | 2380           | 3.3765770 |
| 2315           | 3.3645510 | 2348           | 3.3706981 | 2381           | 3.3767594 |
| 2316           | 3.3647386 | 2349           | 3.3708830 | 2382           | 3.3769418 |
| 2317           | 3.3649260 | 2350           | 3.3710679 | 2383           | 3.3771240 |
| 2318           | 3.3651134 | 2351           | 3.3712526 | 2384           | 3.3773062 |
| 2319           | 3.3653007 | 2352           | 3.3714373 | 2385           | 3.3774884 |
| 2320           | 3.3654880 | 2353           | 3.3716219 | 2386           | 3.3776704 |
| 2321           | 3.3656751 | 2354           | 3.3718065 | 2387           | 3.3778524 |
| 2322           | 3.3658622 | 2355           | 3.3719909 | 2388           | 3.3780343 |
| 2323           | 3.3660492 | 2356           | 3.3721753 | 2389           | 3.3782161 |
| 2324           | 3.3662361 | 2357           | 3.3723596 | 2390           | 3.3783979 |
| 2325           | 3.3664230 | 2458           | 3.3725438 | 2391           | 3.3785796 |
| 2326           | 3.3666097 | 2359           | 3.3727279 | 2392           | 3.3787612 |
| 2327           | 3.3667964 | 2360           | 3.3729120 | 2393           | 3.3789427 |
| 2328           | 3.3669830 | 2361           | 3.3730960 | 2394           | 3.3791241 |
| 2329           | 3.3671695 | 2362           | 3.3732799 | 2395           | 3.3793055 |
| 2330           | 3.3673559 | 2363           | 3.3734637 | 2396           | 3.3794868 |
| 2331           | 3.3675423 | 2364           | 3.3736475 | 2397           | 3.3796680 |
| 2332           | 3.3677285 | 2365           | 3.3738311 | 2398           | 3.3798492 |
| 2333           | 3.3679147 | 2366           | 3.3740147 | 2399           | 3.3800302 |
| 2334           | 3.3681008 | 2367           | 3.3741983 | 2400           | 3.3802112 |

2400 A TABLE OF LOGARITHMS. 0075

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 2401           | 3.3803972 | 2434           | 3.3863206 | 2467           | 3.3921691 |
| 2402           | 3.3805730 | 2435           | 3.3864990 | 2468           | 3.3923452 |
| 2403           | 3.3807538 | 2436           | 3.3866773 | 2469           | 3.3925211 |
| 2404           | 3.3809345 | 2437           | 3.3868555 | 2470           | 3.3926970 |
| 2405           | 3.3811151 | 2438           | 3.3870337 | 2471           | 3.3928727 |
| 2406           | 3.3812956 | 2439           | 3.3872118 | 2472           | 3.3930485 |
| 2407           | 3.3814761 | 2440           | 3.3873898 | 2473           | 3.3932241 |
| 2408           | 3.3816565 | 2441           | 3.3875678 | 2474           | 3.3933997 |
| 2409           | 3.3818368 | 2442           | 3.3877457 | 2475           | 3.3935752 |
| 2410           | 3.3820170 | 2443           | 3.3879235 | 2476           | 3.3937506 |
| 2411           | 3.3821972 | 2444           | 3.3881012 | 2477           | 3.3939260 |
| 2412           | 3.3823773 | 2445           | 3.3882789 | 2478           | 3.3941013 |
| 2413           | 3.3825573 | 2446           | 3.3884565 | 2479           | 3.3942765 |
| 2414           | 3.3827373 | 2447           | 3.3886340 | 2480           | 3.3944517 |
| 2415           | 3.3829171 | 2448           | 3.3888114 | 2481           | 3.3946268 |
| 2416           | 3.3830969 | 2449           | 3.3889888 | 2482           | 3.3948018 |
| 2417           | 3.3832765 | 2450           | 3.3891661 | 2483           | 3.3949767 |
| 2418           | 3.3834563 | 2451           | 3.3893433 | 2484           | 3.3951516 |
| 2419           | 3.3836359 | 2452           | 3.3895205 | 2485           | 3.3953264 |
| 2420           | 3.3838154 | 2453           | 3.3896975 | 2486           | 3.3955011 |
| 2421           | 3.3839948 | 2454           | 3.3898746 | 2487           | 3.3956758 |
| 2422           | 3.3841741 | 2455           | 3.3900515 | 2488           | 3.3958504 |
| 2423           | 3.3843534 | 2456           | 3.3902284 | 2489           | 3.3960249 |
| 2424           | 3.3845326 | 2457           | 3.3904052 | 2490           | 3.3961993 |
| 2425           | 3.3847117 | 2458           | 3.3905819 | 2491           | 3.3963737 |
| 2426           | 3.3848908 | 2459           | 3.3907585 | 2492           | 3.3965480 |
| 2427           | 3.3850698 | 2460           | 3.3909351 | 2493           | 3.3967223 |
| 2428           | 3.3852487 | 2461           | 3.3911116 | 2494           | 3.3968964 |
| 2429           | 3.3854275 | 2462           | 3.3912880 | 2495           | 3.3970705 |
| 2430           | 3.3856063 | 2463           | 3.3914644 | 2496           | 3.3972446 |
| 2431           | 3.3857850 | 2464           | 3.3916407 | 2497           | 3.3974185 |
| 2432           | 3.3859636 | 2465           | 3.3918169 | 2498           | 3.3975924 |
| 2433           | 3.3861421 | 2466           | 3.3919931 | 2499           | 3.3977663 |
| 2434           | 3.3863206 | 2467           | 3.3921691 | 2500           | 3.3979400 |
| 0000           |           |                |           | 2500           |           |

# 2500 · A TABLE OF LOGARITHMS. COAS

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 2501           | 3.3981137 | 2534           | 3.4038067 | 2567           | 3.4094259 |
| 2502           | 3.3982873 | 2535           | 3.4039780 | 2568           | 3.4095950 |
| 2503           | 3.3984608 | 2536           | 3.4041492 | 2569           | 3.4097641 |
| 2504           | 3.3986343 | 2537           | 3.4043205 | 2570           | 3.4099331 |
| 2505           | 3.3988077 | 2538           | 3.4044916 | 2571           | 3.4101021 |
| 2506           | 3.3989811 | 2539           | 3.4046627 | 2572           | 3.4102710 |
| 2507           | 3.3991543 | 2540           | 3.4048337 | 2573           | 3.4104398 |
| 2508           | 3.3993275 | 2541           | 3.4050047 | 2574           | 3.4106085 |
| 2509           | 3.3995007 | 2542           | 3.4051755 | 2575           | 3.4107772 |
| 2510           | 3.3996737 | 2543           | 3.4053464 | 2576           | 3.4109459 |
| 2511           | 3.3998467 | 2544           | 3.4055171 | 2577           | 3.4111144 |
| 2512           | 3.4000196 | 2545           | 3.4056878 | 2578           | 3.4112829 |
| 2513           | 3.4001925 | 2546           | 3.4058584 | 2579           | 3.4114513 |
| 2514           | 3.4003653 | 2547           | 3.4060289 | 2580           | 3.4116197 |
| 2515           | 3.4005380 | 2548           | 3.4061994 | 2581           | 3.4117880 |
| 2516           | 3.4007106 | 2549           | 3.4063698 | 2582           | 3.4119562 |
| 2517           | 3.4008832 | 2550           | 3.4065402 | 2583           | 3.4121244 |
| 2518           | 3.4010557 | 2551           | 3.4067105 | 2584           | 3.4122925 |
| 2519           | 3.4012282 | 2552           | 3.4068807 | 2585           | 3.4124605 |
| 2520           | 3.4014005 | 2553           | 3.4070508 | 2586           | 3.4126285 |
| 2521           | 3.4015728 | 2554           | 3.4072209 | 2587           | 3.4127964 |
| 2522           | 3.4017451 | 2555           | 3.4073909 | 2588           | 3.4129643 |
| 2523           | 3.4019173 | 2556           | 3.4075608 | 2589           | 3.4131320 |
| 2524           | 3.4020893 | 2557           | 3.4077307 | 2590           | 3.4132998 |
| 2525           | 3.4022614 | 2558           | 3.4079005 | 2591           | 3.4134674 |
| 2526           | 3.4024333 | 2559           | 3.4080703 | 2592           | 3.4136350 |
| 2527           | 3.4026052 | 2560           | 3.4082400 | 2593           | 3.4138025 |
| 2528           | 3.4027771 | 2461           | 3.4084096 | 2594           | 3.4139700 |
| 2529           | 3.4029488 | 2562           | 3.4085791 | 2595           | 3.4141374 |
| 2530           | 3.4031205 | 2563           | 3.4087486 | 2596           | 3.4143047 |
| 2531           | 3.4032921 | 2564           | 3.4089180 | 2597           | 3.4144719 |
| 2532           | 3.4034637 | 2565           | 3.4090874 | 2598           | 3.4146391 |
| 2533           | 3.4036352 | 2566           | 3.4092567 | 2599           | 3.4148063 |
| 2534           | 3.4038066 | 2567           | 3.4094259 | 2600           | 3.4149733 |

2600



# 2600. A TABLE of LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 2601           | 3.4151404 | 2634           | 3.4206158 | 2667           | 3.4260230 |
| 2602           | 3.4153073 | 2635           | 3.4207806 | 2668           | 3.4261858 |
| 2603           | 3.4154742 | 2636           | 3.4209454 | 2669           | 3.4263486 |
| 2604           | 3.4156410 | 2637           | 3.4211101 | 2670           | 3.4265112 |
| 2605           | 3.4158077 | 2638           | 3.4212748 | 2671           | 3.4266739 |
| 2606           | 3.4159744 | 2639           | 3.4214394 | 2672           | 3.4268365 |
| 2607           | 3.4161410 | 2640           | 3.4216039 | 2673           | 3.4269990 |
| 2608           | 3.4163076 | 2641           | 3.4217684 | 2674           | 3.4271614 |
| 2609           | 3.4164741 | 2642           | 3.4219328 | 2675           | 3.4273238 |
| 2610           | 3.4166405 | 2643           | 3.4220972 | 2676           | 3.4274861 |
| 2611           | 3.4168069 | 2644           | 3.4222614 | 2677           | 3.4276484 |
| 2612           | 3.4169732 | 2645           | 3.4224257 | 2678           | 3.4278106 |
| 2613           | 3.4171394 | 2646           | 3.4225898 | 2679           | 3.4279727 |
| 2614           | 3.4173056 | 2647           | 3.4227539 | 2680           | 3.4281348 |
| 2615           | 3.4174717 | 2648           | 3.4229180 | 2681           | 3.4282968 |
| 2616           | 3.4176377 | 2649           | 3.4230820 | 2682           | 3.4284588 |
| 2617           | 3.4178037 | 2650           | 3.4232459 | 2683           | 3.4286207 |
| 2618           | 3.4179696 | 2651           | 3.4234097 | 2684           | 3.4287825 |
| 2619           | 3.4181355 | 2652           | 3.4235735 | 2685           | 3.4289443 |
| 2620           | 3.4183013 | 2653           | 3.4237372 | 2686           | 3.4291060 |
| 2621           | 3.4184670 | 2654           | 3.4239009 | 2687           | 3.4292677 |
| 2622           | 3.4186327 | 2655           | 3.4240645 | 2688           | 3.4294293 |
| 2623           | 3.4187983 | 2656           | 3.4242281 | 2689           | 3.4295908 |
| 2624           | 3.4189638 | 2657           | 3.4243916 | 2690           | 3.4297523 |
| 2625           | 3.4191293 | 2658           | 3.4245550 | 2691           | 3.4299137 |
| 2626           | 3.4192947 | 2659           | 3.4247183 | 2692           | 3.4300751 |
| 2627           | 3.4194601 | 2660           | 3.4248816 | 2693           | 3.4302363 |
| 2628           | 3.4196254 | 2661           | 3.4250449 | 2694           | 3.4303976 |
| 2629           | 3.4197906 | 2662           | 3.4252081 | 2695           | 3.4305588 |
| 2630           | 3.4199557 | 2663           | 3.4253712 | 2696           | 3.4307199 |
| 2631           | 3.4201208 | 2664           | 3.4255342 | 2697           | 3.4308809 |
| 2632           | 3.4202859 | 2665           | 3.4256972 | 2698           | 3.4310419 |
| 2633           | 3.4204509 | 2666           | 3.4258601 | 2699           | 3.4312029 |
| 2634           | 3.4206158 | 2667           | 3.4260230 | 2700           | 3.4313638 |

# 2700 A TABLE OF LOGARITHMS. 0008

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 2701           | 3.4345246 | 2734           | 3.4367985 | 2767           | 3.4426092 |
| 2702           | 3.4346853 | 2735           | 3.4369573 | 2768           | 3.4427661 |
| 2703           | 3.4348460 | 2736           | 3.4371161 | 2769           | 3.4429230 |
| 2704           | 3.4350067 | 2737           | 3.4372748 | 2770           | 3.4430798 |
| 2705           | 3.4351673 | 2738           | 3.4374334 | 2771           | 3.4432365 |
| 2706           | 3.4353278 | 2739           | 3.4375920 | 2772           | 3.4433932 |
| 2707           | 3.4354883 | 2740           | 3.4377506 | 2773           | 3.4435499 |
| 2708           | 3.4356487 | 2741           | 3.4379090 | 2774           | 3.4437065 |
| 2709           | 3.4358090 | 2742           | 3.4380674 | 2775           | 3.4438636 |
| 2710           | 3.4359693 | 2743           | 3.4382258 | 2776           | 3.4440195 |
| 2711           | 3.4361295 | 2744           | 3.4383841 | 2777           | 3.4441759 |
| 2712           | 3.4362897 | 2745           | 3.4385423 | 2778           | 3.4443322 |
| 2713           | 3.4364498 | 2746           | 3.4387005 | 2779           | 3.4444883 |
| 2714           | 3.4366098 | 2747           | 3.4388587 | 2780           | 3.4446448 |
| 2715           | 3.4367698 | 2748           | 3.4390167 | 2781           | 3.4448016 |
| 2716           | 3.4369298 | 2749           | 3.4391747 | 2782           | 3.4449578 |
| 2717           | 3.4370896 | 2750           | 3.4393327 | 2783           | 3.4451132 |
| 2718           | 3.4372495 | 2751           | 3.4394906 | 2784           | 3.4452689 |
| 2719           | 3.4374092 | 2752           | 3.4396484 | 2785           | 3.4454252 |
| 2720           | 3.4375689 | 2753           | 3.4398062 | 2786           | 3.4455814 |
| 2721           | 3.4377285 | 2754           | 3.4399639 | 2787           | 3.4457376 |
| 2722           | 3.4378881 | 2755           | 3.4401216 | 2788           | 3.4458928 |
| 2723           | 3.4380476 | 2756           | 3.4402792 | 2789           | 3.4460485 |
| 2724           | 3.4382071 | 2757           | 3.4404368 | 2790           | 3.4462042 |
| 2725           | 3.4383665 | 2758           | 3.4405943 | 2791           | 3.4463598 |
| 2726           | 3.4385259 | 2759           | 3.4407517 | 2792           | 3.4465154 |
| 2727           | 3.4386851 | 2760           | 3.4409091 | 2793           | 3.4466709 |
| 2728           | 3.4388444 | 2761           | 3.4410664 | 2794           | 3.4468264 |
| 2729           | 3.4390035 | 2762           | 3.4412237 | 2795           | 3.4469818 |
| 2730           | 3.4391626 | 2763           | 3.4413809 | 2796           | 3.4471372 |
| 2731           | 3.4393217 | 2764           | 3.4415380 | 2797           | 3.4472925 |
| 2732           | 3.4394807 | 2765           | 3.4416951 | 2798           | 3.4474477 |
| 2733           | 3.4396396 | 2766           | 3.4418522 | 2799           | 3.4476029 |
| 2734           | 3.4397985 | 2767           | 3.4420092 | 2800           | 3.4477580 |

# 2800 A TABLE of LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 2801           | 3.4473131 | 2834           | 3.4523998 | 2867           | 3.4574277 |
| 2802           | 3.4474681 | 2835           | 3.4525531 | 2868           | 3.4575791 |
| 2803           | 3.4476231 | 2836           | 3.4527062 | 2869           | 3.4577305 |
| 2804           | 3.4477780 | 2837           | 3.4528593 | 2870           | 3.4578819 |
| 2805           | 3.4479329 | 2838           | 3.4530124 | 2871           | 3.4580332 |
| 2806           | 3.4480877 | 2839           | 3.4531654 | 2872           | 3.4581844 |
| 2807           | 3.4482424 | 2840           | 3.4533183 | 2873           | 3.4583356 |
| 2808           | 3.4483971 | 2841           | 3.4534712 | 2874           | 3.4584868 |
| 2809           | 3.4485517 | 2842           | 3.4536241 | 2875           | 3.4586378 |
| 2810           | 3.4487063 | 2843           | 3.4537769 | 2876           | 3.4587889 |
| 2811           | 3.4488608 | 2844           | 3.4539296 | 2877           | 3.4589399 |
| 2812           | 3.4490153 | 2845           | 3.4540823 | 2878           | 3.4590908 |
| 2813           | 3.4491697 | 2846           | 3.4542349 | 2879           | 3.4592417 |
| 2814           | 3.4493241 | 2847           | 3.4543875 | 2880           | 3.4593925 |
| 2815           | 3.4494784 | 2848           | 3.4545400 | 2881           | 3.4595433 |
| 2816           | 3.4496327 | 2849           | 3.4546924 | 2882           | 3.4596940 |
| 2817           | 3.4497868 | 2850           | 3.4548449 | 2883           | 3.4598446 |
| 2818           | 3.4499410 | 2851           | 3.4549972 | 2884           | 3.4599953 |
| 2819           | 3.4500951 | 2852           | 3.4551495 | 2885           | 3.4601458 |
| 2820           | 3.4502491 | 2853           | 3.4553018 | 2886           | 3.4602963 |
| 2821           | 3.4504031 | 2854           | 3.4554540 | 2887           | 3.4604468 |
| 2822           | 3.4505570 | 2855           | 3.4556061 | 2888           | 3.4605972 |
| 2823           | 3.4507109 | 2856           | 3.4557582 | 2889           | 3.4607475 |
| 2824           | 3.4508647 | 2857           | 3.4559102 | 2890           | 3.4608978 |
| 2825           | 3.4510185 | 2858           | 3.4560622 | 2891           | 3.4610481 |
| 2826           | 3.4511722 | 2859           | 3.4562142 | 2892           | 3.4611983 |
| 2827           | 3.4513258 | 2860           | 3.4563660 | 2893           | 3.4613484 |
| 2828           | 3.4514794 | 2861           | 3.4565179 | 2894           | 3.4614985 |
| 2829           | 3.4516329 | 2862           | 3.4566696 | 2895           | 3.4616486 |
| 2830           | 3.4517864 | 2863           | 3.4568213 | 2896           | 3.4617986 |
| 2831           | 3.4519399 | 2864           | 3.4569730 | 2897           | 3.4619485 |
| 2832           | 3.4520932 | 2865           | 3.4571246 | 2898           | 3.4620984 |
| 2833           | 3.4522466 | 2866           | 3.4572762 | 2899           | 3.4622482 |
| 2834           | 3.4523998 | 2867           | 3.4574277 | 2900           | 3.4623980 |



# 2900 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 2901           | 3.4625477 | 2934           | 3.4674601 | 2967           | 3.4723175 |
| 2902           | 3.4626974 | 2935           | 3.4676081 | 2968           | 3.4724639 |
| 2903           | 3.4628470 | 2936           | 3.4677561 | 2969           | 3.4726102 |
| 2904           | 3.4629966 | 2937           | 3.4679039 | 2970           | 3.4727564 |
| 2905           | 3.4631461 | 2938           | 3.4680518 | 2971           | 3.4729027 |
| 2906           | 3.4632956 | 2939           | 3.4681996 | 2972           | 3.4730488 |
| 2907           | 3.4634450 | 2940           | 3.4683473 | 2973           | 3.4731949 |
| 2908           | 3.4635944 | 2941           | 3.4684950 | 2974           | 3.4733410 |
| 2909           | 3.4637437 | 2942           | 3.4686427 | 2975           | 3.4734870 |
| 2910           | 3.4638930 | 2943           | 3.4687903 | 2976           | 3.4736329 |
| 2911           | 3.4640422 | 2944           | 3.4689378 | 2977           | 3.4737788 |
| 2912           | 3.4641914 | 2945           | 3.4690853 | 2978           | 3.4739247 |
| 2913           | 3.4643405 | 2946           | 3.4692327 | 2979           | 3.4740705 |
| 2914           | 3.4644895 | 2947           | 3.4693801 | 2980           | 3.4742163 |
| 2915           | 3.4646386 | 2948           | 3.4695275 | 2981           | 3.4743620 |
| 2916           | 3.4647875 | 2949           | 3.4696748 | 2982           | 3.4745076 |
| 2917           | 3.4649364 | 2950           | 3.4698220 | 2983           | 3.4746533 |
| 2918           | 3.4650853 | 2951           | 3.4699692 | 2984           | 3.4747988 |
| 2919           | 3.4652341 | 2952           | 3.4701164 | 2985           | 3.4749443 |
| 2920           | 3.4653829 | 2953           | 3.4702634 | 2986           | 3.4750898 |
| 2921           | 3.4655316 | 2954           | 3.4704105 | 2987           | 3.4752352 |
| 2922           | 3.4656802 | 2955           | 3.4705575 | 2988           | 3.4753806 |
| 2923           | 3.4658288 | 2956           | 3.4707044 | 2989           | 3.4755259 |
| 2924           | 3.4659774 | 2957           | 3.4708513 | 2990           | 3.4756712 |
| 2925           | 3.4661259 | 2958           | 3.4709982 | 2991           | 3.4758164 |
| 2926           | 3.4662743 | 2959           | 3.4711450 | 2992           | 3.4759619 |
| 2927           | 3.4664227 | 2960           | 3.4712917 | 2993           | 3.4761067 |
| 2928           | 3.4665711 | 2961           | 3.4714384 | 2994           | 3.4762518 |
| 2929           | 3.4667194 | 2962           | 3.4715851 | 2995           | 3.4763968 |
| 2930           | 3.4668676 | 2963           | 3.4717317 | 2996           | 3.4765418 |
| 2931           | 3.4670158 | 2964           | 3.4718782 | 2997           | 3.4766867 |
| 2932           | 3.4671640 | 2965           | 3.4720247 | 2998           | 3.4768316 |
| 2933           | 3.4673121 | 2966           | 3.4721711 | 2999           | 3.4769765 |
| 2934           | 3.4674601 | 2967           | 3.4723175 | 3000           | 3.4771213 |

# 3000 A TABLE of LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 3001           | 3.4772660 | 3034           | 3.4820156 | 3067           | 3.4867138 |
| 3002           | 3.4774107 | 3035           | 3.4821587 | 3068           | 3.4868554 |
| 3003           | 3.4775553 | 3036           | 3.4823018 | 3069           | 3.4869969 |
| 3004           | 3.4776999 | 3037           | 3.4824448 | 3070           | 3.4871384 |
| 3005           | 3.4778445 | 3038           | 3.4825878 | 3071           | 3.4872798 |
| 3006           | 3.4779890 | 3039           | 3.4827307 | 3072           | 3.4874212 |
| 3007           | 3.4781334 | 3040           | 3.4828736 | 3073           | 3.4875626 |
| 3008           | 3.4782778 | 3041           | 3.4830164 | 3074           | 3.4877039 |
| 3009           | 3.4784222 | 3042           | 3.4831592 | 3075           | 3.4878451 |
| 3010           | 3.4785665 | 3043           | 3.4833020 | 3076           | 3.4879861 |
| 3011           | 3.4787108 | 3044           | 3.4834446 | 3077           | 3.4881275 |
| 3012           | 3.4788550 | 3045           | 3.4835873 | 3078           | 3.4882686 |
| 3013           | 3.4789991 | 3046           | 3.4837299 | 3079           | 3.4884097 |
| 3014           | 3.4791432 | 3047           | 3.4838725 | 3080           | 3.4885507 |
| 3015           | 3.4792873 | 3048           | 3.4840150 | 3081           | 3.4886917 |
| 3016           | 3.4794313 | 3049           | 3.4841574 | 3082           | 3.4888326 |
| 3017           | 3.4795753 | 3050           | 3.4842998 | 3083           | 3.4889735 |
| 3018           | 3.4797192 | 3051           | 3.4844422 | 3084           | 3.4891144 |
| 3019           | 3.4798631 | 3052           | 3.4845845 | 3085           | 3.4892552 |
| 3020           | 3.4800069 | 3053           | 3.4847268 | 3086           | 3.4893959 |
| 3021           | 3.4801507 | 3054           | 3.4848690 | 3087           | 3.4895366 |
| 3022           | 3.4802945 | 3055           | 3.4850112 | 3088           | 3.4896773 |
| 3023           | 3.4804381 | 3056           | 3.4851533 | 3089           | 3.4898179 |
| 3024           | 3.4805818 | 3057           | 3.4852954 | 3090           | 3.4899585 |
| 3025           | 3.4807254 | 3058           | 3.4854375 | 3091           | 3.4900990 |
| 3026           | 3.4808689 | 3059           | 3.4855795 | 3092           | 3.4902395 |
| 3027           | 3.4810124 | 3060           | 3.4857214 | 3093           | 3.4903799 |
| 3028           | 3.4811559 | 3061           | 3.4858633 | 3094           | 3.4905203 |
| 3029           | 3.4812993 | 3062           | 3.4860052 | 3095           | 3.4906607 |
| 3030           | 3.4814426 | 3063           | 3.4861470 | 3096           | 3.4908010 |
| 3031           | 3.4815859 | 3064           | 3.4862888 | 3097           | 3.4909412 |
| 3032           | 3.4817292 | 3065           | 3.4864305 | 3098           | 3.4910814 |
| 3033           | 3.4818724 | 3066           | 3.4865722 | 3099           | 3.4912216 |
| 3034           | 3.4820156 | 3067           | 3.4867138 | 3100           | 3.4913617 |

# 3100 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 3101           | 3.4915018 | 3134           | 3.4960990 | 3167           | 3.5006481 |
| 3102           | 3.4916418 | 3135           | 3.4962375 | 3168           | 3.5007852 |
| 3103           | 3.4917818 | 3136           | 3.4963761 | 3169           | 3.5009222 |
| 3104           | 3.4919217 | 3137           | 3.4965145 | 3170           | 3.5010593 |
| 3105           | 3.4920616 | 3138           | 3.4966529 | 3171           | 3.5011962 |
| 3106           | 3.4922015 | 3139           | 3.4967913 | 3172           | 3.5013332 |
| 3107           | 3.4923413 | 3140           | 3.4969296 | 3173           | 3.5014701 |
| 3108           | 3.4924810 | 3141           | 3.4970679 | 3174           | 3.5016069 |
| 3109           | 3.4926207 | 3142           | 3.4972062 | 3175           | 3.5017437 |
| 3110           | 3.4927604 | 3143           | 3.4973444 | 3176           | 3.5018805 |
| 3111           | 3.4929000 | 3144           | 3.4974825 | 3177           | 3.5020172 |
| 3112           | 3.4930396 | 3145           | 3.4976206 | 3178           | 3.5021539 |
| 3113           | 3.4931791 | 3146           | 3.4977587 | 3179           | 3.5022905 |
| 3114           | 3.4933186 | 3147           | 3.4978967 | 3180           | 3.5024271 |
| 3115           | 3.4934581 | 3148           | 3.4980347 | 3181           | 3.5025637 |
| 3116           | 3.4935974 | 3149           | 3.4981727 | 3182           | 3.5027002 |
| 3117           | 3.4937368 | 3150           | 3.4983106 | 3183           | 3.5028366 |
| 3118           | 3.4938761 | 3151           | 3.4984484 | 3184           | 3.5029731 |
| 3119           | 3.4940154 | 3152           | 3.4985862 | 3185           | 3.5031094 |
| 3120           | 3.4941546 | 3153           | 3.4987240 | 3186           | 3.5032458 |
| 3121           | 3.4942938 | 3154           | 3.4988617 | 3187           | 3.5033821 |
| 3122           | 3.4944329 | 3155           | 3.4989994 | 3188           | 3.5035183 |
| 3123           | 3.4945720 | 3156           | 3.4991370 | 3189           | 3.5036545 |
| 3124           | 3.4947110 | 3157           | 3.4992746 | 3190           | 3.5037907 |
| 3125           | 3.4548500 | 3158           | 3.4994121 | 3191           | 3.5039268 |
| 3126           | 3.4949890 | 3159           | 3.4995496 | 3192           | 3.5040629 |
| 3127           | 3.4951279 | 3160           | 3.4996871 | 3193           | 3.5041989 |
| 3128           | 3.4952667 | 3161           | 3.4998245 | 3194           | 3.5043349 |
| 3129           | 3.4954056 | 3162           | 3.4999619 | 3195           | 3.5044709 |
| 3130           | 3.4955443 | 3163           | 3.5000992 | 3196           | 3.5046068 |
| 3131           | 3.4956831 | 3164           | 3.5002365 | 3197           | 3.5047426 |
| 3132           | 3.4958218 | 3165           | 3.5003737 | 3198           | 3.5048785 |
| 3133           | 3.4959604 | 3166           | 3.5005109 | 3199           | 3.5050142 |
| 3134           | 3.4960990 | 3167           | 3.5006481 | 3100           | 3.5051500 |



# 3200 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 3201           | 3.5052857 | 3234           | 3.5097400 | 3267           | 3.5141491 |
| 3202           | 3.5054213 | 3235           | 3.5098743 | 3268           | 3.5142820 |
| 3203           | 3.5055569 | 3236           | 3.5100085 | 3269           | 3.5144149 |
| 3204           | 3.5056925 | 3237           | 3.5101427 | 3270           | 3.5145478 |
| 3205           | 3.5058280 | 3238           | 3.5102768 | 3271           | 3.5146805 |
| 3206           | 3.5059635 | 3239           | 3.5104109 | 3272           | 3.5148133 |
| 3207           | 3.5060990 | 3240           | 3.5105450 | 3273           | 3.5149460 |
| 3208           | 3.5062344 | 3241           | 3.5106790 | 3274           | 3.5150787 |
| 3209           | 3.5063697 | 3242           | 3.5108130 | 3275           | 3.5152113 |
| 3210           | 3.5065050 | 3243           | 3.5109469 | 3276           | 3.5153439 |
| 3211           | 3.5066403 | 3244           | 3.5110808 | 3277           | 3.5154764 |
| 3212           | 3.5067755 | 3245           | 3.5112147 | 3278           | 3.5156089 |
| 3213           | 3.5069107 | 3246           | 3.5113485 | 3279           | 3.5157414 |
| 3214           | 3.5070459 | 3247           | 3.5114823 | 3280           | 3.5158738 |
| 3215           | 3.5071810 | 3248           | 3.5116160 | 3281           | 3.5160062 |
| 3216           | 3.5073160 | 3249           | 3.5117497 | 3282           | 3.5161386 |
| 3217           | 3.5074511 | 3250           | 3.5118834 | 3283           | 3.5162709 |
| 3218           | 3.5075860 | 3251           | 3.5120170 | 3284           | 3.5164031 |
| 3219           | 3.5077210 | 3252           | 3.5121505 | 3285           | 3.5165354 |
| 3220           | 3.5078559 | 3253           | 3.5122841 | 3286           | 3.5166676 |
| 3221           | 3.5079907 | 3254           | 3.5124175 | 3287           | 3.5167997 |
| 3222           | 3.5081255 | 3255           | 3.5125510 | 3288           | 3.5169318 |
| 3223           | 3.5082603 | 3256           | 3.5126844 | 3289           | 3.5170639 |
| 3224           | 3.5083950 | 3257           | 3.5128178 | 3290           | 3.5171959 |
| 3225           | 3.5085297 | 3258           | 3.5129511 | 3291           | 3.5173279 |
| 3226           | 3.5086644 | 3259           | 3.5130844 | 3292           | 3.5174598 |
| 3227           | 3.5087990 | 3260           | 3.5132176 | 3293           | 3.5175917 |
| 3228           | 3.5089335 | 3261           | 3.5133508 | 3294           | 3.5177236 |
| 3229           | 3.5090680 | 3262           | 3.5134840 | 3295           | 3.5178554 |
| 3230           | 3.5092025 | 3263           | 3.5136171 | 3296           | 3.5179872 |
| 3231           | 3.5093370 | 3264           | 3.5137502 | 3297           | 3.5181189 |
| 3232           | 3.5094714 | 3265           | 3.5138832 | 3298           | 3.5182507 |
| 3233           | 3.5096057 | 3266           | 3.5140162 | 3299           | 3.5183823 |
| 3234           | 3.5097400 | 3267           | 3.5141491 | 3300           | 3.5185139 |

3300

# 3300 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 3301           | 3.5186455 | 3334           | 3.5229656 | 3367           | 3.5272431 |
| 3302           | 3.5187771 | 3335           | 3.5230958 | 3368           | 3.5273721 |
| 3303           | 3.5189086 | 3336           | 3.5232260 | 3369           | 3.5275010 |
| 3304           | 3.5190400 | 3337           | 3.5233562 | 3370           | 3.5276299 |
| 3305           | 3.5191715 | 3338           | 3.5234863 | 3371           | 3.5277588 |
| 3306           | 3.5193028 | 3339           | 3.5236164 | 3372           | 3.5278876 |
| 3307           | 3.5194342 | 3340           | 3.5237465 | 3373           | 3.5280163 |
| 3308           | 3.5195655 | 3341           | 3.5238765 | 3374           | 3.5281451 |
| 3309           | 3.5196968 | 3342           | 3.5240064 | 3375           | 3.5282738 |
| 3310           | 3.5198280 | 3343           | 3.5241364 | 3376           | 3.5284024 |
| 3311           | 3.5199592 | 3344           | 3.5242663 | 3377           | 3.5285311 |
| 3312           | 3.5200903 | 3345           | 3.5243961 | 3378           | 3.5286596 |
| 3313           | 3.5202214 | 3346           | 3.5245259 | 3379           | 3.5287882 |
| 3314           | 3.5203525 | 3347           | 3.5246557 | 3380           | 3.5289167 |
| 3315           | 3.5204835 | 3348           | 3.5247854 | 3381           | 3.5290452 |
| 3316           | 3.5206145 | 3349           | 3.5249151 | 3382           | 3.5291736 |
| 3317           | 3.5207455 | 3350           | 3.5250448 | 3383           | 3.5293020 |
| 3318           | 3.5208764 | 3351           | 3.5251744 | 3384           | 3.5294304 |
| 3319           | 3.5210073 | 3352           | 3.5253040 | 3385           | 3.5295587 |
| 3320           | 3.5211381 | 3353           | 3.5254336 | 3386           | 3.5296870 |
| 3321           | 3.5212689 | 3354           | 3.5255631 | 3387           | 3.5298152 |
| 3322           | 3.5213996 | 3355           | 3.5256925 | 3388           | 3.5299434 |
| 3323           | 3.5215303 | 3356           | 3.5258220 | 3389           | 3.5300716 |
| 3324           | 3.5216610 | 3357           | 3.5259513 | 3390           | 3.5301997 |
| 3325           | 3.5217916 | 3358           | 3.5260807 | 3391           | 3.5303278 |
| 3326           | 3.5219222 | 3359           | 3.5262100 | 3392           | 3.5304558 |
| 3327           | 3.5220528 | 3360           | 3.5263393 | 3393           | 3.5305839 |
| 3328           | 3.5221833 | 3361           | 3.5264685 | 3394           | 3.5307118 |
| 3329           | 3.5223138 | 3362           | 3.5265977 | 3395           | 3.5308398 |
| 3330           | 3.5224442 | 3363           | 3.5267269 | 3396           | 3.5309677 |
| 3331           | 3.5225746 | 3364           | 3.5268560 | 3397           | 3.5310955 |
| 3332           | 3.5227050 | 3365           | 3.5269851 | 3398           | 3.5312234 |
| 3333           | 3.5228353 | 3366           | 3.5271141 | 3399           | 3.5313512 |
| 3334           | 3.5229656 | 3367           | 3.5272431 | 3400           | 3.5314789 |

# 3400 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 3401           | 3.5316066 | 3434           | 3.5358003 | 3467           | 3.5399538 |
| 3402           | 3.5317343 | 3435           | 3.5359267 | 3468           | 3.5400791 |
| 3403           | 3.5318619 | 3436           | 3.5360532 | 3469           | 3.5402043 |
| 3404           | 3.5319896 | 3437           | 3.5361795 | 3470           | 3.5403295 |
| 3405           | 3.5321171 | 3438           | 3.5363059 | 3471           | 3.5404546 |
| 3406           | 3.5322446 | 3439           | 3.5364322 | 3472           | 3.5405797 |
| 3407           | 3.5323721 | 3440           | 3.5365584 | 3473           | 3.5407048 |
| 3408           | 3.5324995 | 3441           | 3.5366847 | 3474           | 3.5408298 |
| 3409           | 3.5326270 | 3442           | 3.5368109 | 3475           | 3.5409548 |
| 3410           | 3.5327544 | 3443           | 3.5369370 | 3476           | 3.5410798 |
| 3411           | 3.5328817 | 3444           | 3.5370631 | 3477           | 3.5412047 |
| 3412           | 3.5330090 | 3445           | 3.5371892 | 3478           | 3.5413296 |
| 3413           | 3.5331363 | 3446           | 3.5373153 | 3479           | 3.5414544 |
| 3414           | 3.5332635 | 3447           | 3.5374413 | 3480           | 3.5415792 |
| 3415           | 3.5333907 | 3448           | 3.5375673 | 3481           | 3.5417040 |
| 3416           | 3.5335179 | 3449           | 3.5376932 | 3482           | 3.5418288 |
| 3417           | 3.5336450 | 3450           | 3.5378191 | 3483           | 3.5419535 |
| 3418           | 3.5337721 | 3451           | 3.5379450 | 3484           | 3.5420781 |
| 3419           | 3.5338991 | 3452           | 3.5380708 | 3485           | 3.5422028 |
| 3420           | 3.5340261 | 3453           | 3.5381966 | 3486           | 3.5423274 |
| 3421           | 3.5341531 | 3454           | 3.5383223 | 3487           | 3.5424519 |
| 3422           | 3.5342800 | 3455           | 3.5384481 | 3488           | 3.5425765 |
| 3423           | 3.5344069 | 3456           | 3.5385737 | 3489           | 3.5427010 |
| 3424           | 3.5345338 | 3457           | 3.5386994 | 3490           | 3.5428254 |
| 3425           | 3.5346606 | 3458           | 3.5388250 | 3491           | 3.5429498 |
| 3426           | 3.5347874 | 3459           | 3.5389500 | 3492           | 3.5430742 |
| 3427           | 3.5349141 | 3460           | 3.5390761 | 3493           | 3.5431986 |
| 3428           | 3.5350408 | 3461           | 3.5392016 | 3494           | 3.5433229 |
| 3429           | 3.5351675 | 3462           | 3.5393271 | 3495           | 3.5434472 |
| 3430           | 3.5352941 | 3463           | 3.5394525 | 3496           | 3.5435714 |
| 3431           | 3.5354207 | 3464           | 3.5395779 | 3497           | 3.5436956 |
| 3432           | 3.5355473 | 3465           | 3.5397032 | 3498           | 3.5438198 |
| 3433           | 3.5356738 | 3466           | 3.5398286 | 3499           | 3.5439439 |
| 3434           | 3.5358003 | 3467           | 3.5399538 | 3500           | 3.5440680 |



# 3500 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 3501           | 3.5441921 | 3534           | 3.5482665 | 3567           | 3.5523031 |
| 3502           | 3.5443161 | 3535           | 3.5483894 | 3568           | 3.5524248 |
| 3503           | 3.5444401 | 3536           | 3.5485123 | 3569           | 3.5525465 |
| 3504           | 3.5445641 | 3537           | 3.5486351 | 3570           | 3.5526682 |
| 3505           | 3.5446880 | 3538           | 3.5487578 | 3571           | 3.5527899 |
| 3506           | 3.5448119 | 3539           | 3.5488806 | 3572           | 3.5529115 |
| 3507           | 3.5449358 | 3540           | 3.5490033 | 3573           | 3.5530330 |
| 3508           | 3.5450596 | 3541           | 3.5491259 | 3574           | 3.5531545 |
| 3509           | 3.5451834 | 3542           | 3.5492486 | 3575           | 3.5532760 |
| 3510           | 3.5453071 | 3543           | 3.5493712 | 3576           | 3.5533975 |
| 3511           | 3.5454308 | 3544           | 3.5494937 | 3577           | 3.5535189 |
| 3512           | 3.5455545 | 3545           | 3.5496162 | 3578           | 3.5536403 |
| 3513           | 3.5456781 | 3546           | 3.5497387 | 3579           | 3.5537617 |
| 3514           | 3.5458018 | 3547           | 3.5498612 | 3580           | 3.5538830 |
| 3515           | 3.5459253 | 3548           | 3.5499836 | 3581           | 3.5540043 |
| 3516           | 3.5460489 | 3549           | 3.5501060 | 3582           | 3.5541256 |
| 3517           | 3.5461724 | 3550           | 3.5502284 | 3583           | 3.5542468 |
| 3518           | 3.5462958 | 3551           | 3.5503507 | 3584           | 3.5543680 |
| 3519           | 3.5464193 | 3552           | 3.5504730 | 3585           | 3.5544892 |
| 3520           | 3.5465427 | 3553           | 3.5505952 | 3586           | 3.5546103 |
| 3521           | 3.5466660 | 3554           | 3.5507174 | 3587           | 3.5547314 |
| 3522           | 3.5467894 | 3555           | 3.5508396 | 3588           | 3.5548524 |
| 3523           | 3.5469126 | 3556           | 3.5509618 | 3589           | 3.5549735 |
| 3524           | 3.5470359 | 3557           | 3.5510839 | 3590           | 3.5550944 |
| 3525           | 3.5471591 | 3558           | 3.5512059 | 3591           | 3.5552154 |
| 3526           | 3.5472823 | 3559           | 3.5513280 | 3592           | 3.5553363 |
| 3527           | 3.5474055 | 3560           | 3.5514500 | 3593           | 3.5554572 |
| 3528           | 3.5475286 | 3561           | 3.5515720 | 3594           | 3.5555781 |
| 3529           | 3.5476517 | 3562           | 3.5516939 | 3595           | 3.5556989 |
| 3530           | 3.5477747 | 3563           | 3.5518158 | 3596           | 3.5558197 |
| 3531           | 3.5478977 | 3564           | 3.5519377 | 3597           | 3.5559404 |
| 3532           | 3.5480207 | 3565           | 3.5520595 | 3598           | 3.5560612 |
| 3533           | 3.5481436 | 3566           | 3.5521813 | 3599           | 3.5561818 |
| 3534           | 3.5482665 | 3567           | 3.5523031 | 3600           | 3.5563025 |

# 3600 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 3601           | 3.5564231 | 3634           | 3.5603849 | 3667           | 3.5643109 |
| 3602           | 3.5565437 | 3635           | 3.5605044 | 3668           | 3.5644293 |
| 3603           | 3.5566643 | 3636           | 3.5606239 | 3669           | 3.5645477 |
| 3604           | 3.5567848 | 3637           | 3.5607433 | 3670           | 3.5646661 |
| 3605           | 3.5569053 | 3638           | 3.5608627 | 3671           | 3.5647844 |
| 3606           | 3.5570257 | 3639           | 3.5609821 | 3672           | 3.5649027 |
| 3607           | 3.5571461 | 3640           | 3.5611014 | 3673           | 3.5650209 |
| 3608           | 3.5572665 | 3641           | 3.5612207 | 3674           | 3.5651392 |
| 3609           | 3.5573869 | 3642           | 3.5613399 | 3675           | 3.5652573 |
| 3610           | 3.5575072 | 3643           | 3.5614592 | 3676           | 3.5653755 |
| 3611           | 3.5576275 | 3644           | 3.5615784 | 3677           | 3.5654936 |
| 3612           | 3.5577477 | 3645           | 3.5616975 | 3678           | 3.5656117 |
| 3613           | 3.5578680 | 3646           | 3.5618167 | 3679           | 3.5657297 |
| 3614           | 3.5579881 | 3647           | 3.5619358 | 3680           | 3.5658478 |
| 3615           | 3.5581083 | 3648           | 3.5620548 | 3681           | 3.5659658 |
| 3616           | 3.5582284 | 3649           | 3.5621739 | 3682           | 3.5660838 |
| 3617           | 3.5583485 | 3650           | 3.5622929 | 3683           | 3.5662017 |
| 3618           | 3.5584686 | 3651           | 3.5624118 | 3684           | 3.5663196 |
| 3619           | 3.5585886 | 3652           | 3.5625308 | 3685           | 3.5664375 |
| 3620           | 3.5587086 | 3653           | 3.5626497 | 3686           | 3.5665553 |
| 3621           | 3.5588285 | 3654           | 3.5627685 | 3687           | 3.5666731 |
| 3622           | 3.5589484 | 3655           | 3.5628874 | 3688           | 3.5667909 |
| 3623           | 3.5590683 | 3656           | 3.5630062 | 3689           | 3.5669087 |
| 3624           | 3.5591882 | 3657           | 3.5631250 | 3690           | 3.5670264 |
| 3625           | 3.5593080 | 3658           | 3.5632437 | 3691           | 3.5671440 |
| 3626           | 3.5594278 | 3659           | 3.5633624 | 3692           | 3.5672617 |
| 3627           | 3.5595476 | 3660           | 3.5634811 | 3693           | 3.5673793 |
| 3628           | 3.5596673 | 3661           | 3.5635997 | 3694           | 3.5674969 |
| 3629           | 3.5597870 | 3662           | 3.5637183 | 3695           | 3.5676144 |
| 3630           | 3.5599066 | 3663           | 3.5638369 | 3696           | 3.5677320 |
| 3631           | 3.5600262 | 3664           | 3.5639555 | 3697           | 3.5678495 |
| 3632           | 3.5601458 | 3665           | 3.5640740 | 3698           | 3.5679669 |
| 3633           | 3.5602654 | 3666           | 3.5641925 | 3699           | 3.5680843 |
| 3634           | 3.5603849 | 3667           | 3.5643109 | 3700           | 3.5682017 |

# 3700. A TABLE of LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 3701           | 3.5683191 | 3734           | 3.5721743 | 3767           | 3.5759956 |
| 3702           | 3.5684364 | 3735           | 3.5722906 | 3768           | 3.5761109 |
| 3703           | 3.5685537 | 3736           | 3.5724069 | 3769           | 3.5762261 |
| 3704           | 3.5686710 | 3737           | 3.5725231 | 3770           | 3.5763414 |
| 3705           | 3.5687882 | 3738           | 3.5726393 | 3771           | 3.5764565 |
| 3706           | 3.5689054 | 3739           | 3.5727554 | 3772           | 3.5765717 |
| 3707           | 3.5690226 | 3740           | 3.5728716 | 3773           | 3.5766868 |
| 3708           | 3.5691397 | 3741           | 3.5729877 | 3774           | 3.5768019 |
| 3709           | 3.5692568 | 3742           | 3.5731038 | 3775           | 3.5769170 |
| 3710           | 3.5693739 | 3743           | 3.5732198 | 3776           | 3.5770320 |
| 3711           | 3.5694910 | 3744           | 3.5733358 | 3777           | 3.5771470 |
| 3712           | 3.5696080 | 3745           | 3.5734518 | 3778           | 3.5772620 |
| 3713           | 3.5697249 | 3746           | 3.5735678 | 3779           | 3.5773769 |
| 3714           | 3.5698419 | 3747           | 3.5736837 | 3780           | 3.5774918 |
| 3715           | 3.5699588 | 3748           | 3.5737996 | 3781           | 3.5776067 |
| 3716           | 3.5700757 | 3749           | 3.5739154 | 3782           | 3.5777215 |
| 3717           | 3.5701926 | 3750           | 3.5740313 | 3783           | 3.5778363 |
| 3718           | 3.5703094 | 3751           | 3.5741471 | 3784           | 3.5779511 |
| 3719           | 3.5704262 | 3752           | 3.5742628 | 3785           | 3.5780659 |
| 3720           | 3.5705429 | 3753           | 3.5743786 | 3786           | 3.5781806 |
| 3721           | 3.5706597 | 3754           | 3.5744943 | 3787           | 3.5782953 |
| 3722           | 3.5707764 | 3755           | 3.5746099 | 3788           | 3.5784100 |
| 3723           | 3.5708930 | 3756           | 3.5747256 | 3789           | 3.5785246 |
| 3724           | 3.5710097 | 3757           | 3.5748412 | 3790           | 3.5786392 |
| 3725           | 3.5711263 | 3758           | 3.5749568 | 3791           | 3.5787538 |
| 3726           | 3.5712429 | 3759           | 3.5750723 | 3792           | 3.5788683 |
| 3727           | 3.5713594 | 3760           | 3.5751878 | 3793           | 3.5789828 |
| 3728           | 3.5714759 | 3761           | 3.5753033 | 3794           | 3.5790973 |
| 3729           | 3.5715924 | 3762           | 3.5754188 | 3795           | 3.5792118 |
| 3730           | 3.5717088 | 3763           | 3.5755342 | 3796           | 3.5793262 |
| 3731           | 3.5718252 | 3764           | 3.5756496 | 3797           | 3.5794406 |
| 3732           | 3.5719416 | 3765           | 3.5757650 | 3798           | 3.5795550 |
| 3733           | 3.5720580 | 3766           | 3.5758803 | 3799           | 3.5796693 |
| 3734           | 3.5721743 | 3767           | 3.5759956 | 3800           | 3.5797836 |



# 3800 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 3801           | 3.5798979 | 3834           | 3.5836521 | 3867           | 3.5873742 |
| 3802           | 3.5800121 | 3835           | 3.5837654 | 3868           | 3.5874865 |
| 3803           | 3.5801263 | 3836           | 3.5838786 | 3869           | 3.5875987 |
| 3804           | 3.5802405 | 3837           | 3.5839918 | 3870           | 3.5877110 |
| 3805           | 3.5803547 | 3838           | 3.5841050 | 3871           | 3.5878232 |
| 3806           | 3.5804688 | 3839           | 3.5842181 | 3872           | 3.5879353 |
| 3807           | 3.5805829 | 3840           | 3.5843312 | 3873           | 3.5880475 |
| 3808           | 3.5806969 | 3841           | 3.5844443 | 3874           | 3.5881596 |
| 3809           | 3.5808110 | 3842           | 3.5845574 | 3875           | 3.5882717 |
| 3810           | 3.5809250 | 3843           | 3.5846704 | 3876           | 3.5883838 |
| 3811           | 3.5810389 | 3844           | 3.5847834 | 3877           | 3.5884958 |
| 3812           | 3.5811529 | 3845           | 3.5848963 | 3878           | 3.5886078 |
| 3813           | 3.5812668 | 3846           | 3.5850093 | 3879           | 3.5887198 |
| 3814           | 3.5813807 | 3847           | 3.5851222 | 3880           | 3.5888317 |
| 3815           | 3.5814945 | 3848           | 3.5852351 | 3881           | 3.5889436 |
| 3816           | 3.5816084 | 3849           | 3.5853479 | 3882           | 3.5890555 |
| 3817           | 3.5817222 | 3850           | 3.5854607 | 3883           | 3.5891674 |
| 3818           | 3.5818359 | 3851           | 3.5855735 | 3884           | 3.5892792 |
| 3819           | 3.5819497 | 3852           | 3.5856863 | 3885           | 3.5893910 |
| 3820           | 3.5820634 | 3853           | 3.5857990 | 3886           | 3.5895028 |
| 3821           | 3.5821770 | 3854           | 3.5859117 | 3887           | 3.5896145 |
| 3822           | 3.5822907 | 3855           | 3.5860244 | 3888           | 3.5897263 |
| 3823           | 3.5824043 | 3856           | 3.5861370 | 3889           | 3.5898379 |
| 3824           | 3.5825179 | 3857           | 3.5862496 | 3890           | 3.5899496 |
| 3825           | 3.5826314 | 3858           | 3.5863622 | 3891           | 3.5900612 |
| 3826           | 3.5827450 | 3859           | 3.5864748 | 3892           | 3.5901728 |
| 3827           | 3.5828585 | 3860           | 3.5865873 | 3893           | 3.5902844 |
| 3828           | 3.5829719 | 3861           | 3.5866998 | 3894           | 3.5903959 |
| 3829           | 3.5830854 | 3862           | 3.5868123 | 3895           | 3.5905075 |
| 3830           | 3.5831988 | 3863           | 3.5869247 | 3896           | 3.5906189 |
| 3831           | 3.5833122 | 3864           | 3.5870371 | 3897           | 3.5907304 |
| 3832           | 3.5834255 | 3865           | 3.5871495 | 3898           | 3.5908418 |
| 3833           | 3.5835388 | 3866           | 3.5872618 | 3899           | 3.5909532 |
| 3834           | 3.5836521 | 3867           | 3.5873742 | 3900           | 3.5910646 |

# 3900 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 3901           | 3.5911760 | 3934           | 3.5948344 | 3967           | 3.5984622 |
| 3902           | 3.5912873 | 3935           | 3.5949447 | 3968           | 3.5985717 |
| 3903           | 3.5913986 | 3936           | 3.5950551 | 3969           | 3.5986811 |
| 3904           | 3.5915098 | 3937           | 3.5951654 | 3970           | 3.5987905 |
| 3905           | 3.5916210 | 3938           | 3.5952757 | 3971           | 3.5988999 |
| 3906           | 3.5917322 | 3939           | 3.5953860 | 3972           | 3.5990092 |
| 3907           | 3.5918434 | 3940           | 3.5954962 | 3973           | 3.5991186 |
| 3908           | 3.5919546 | 3941           | 3.5956064 | 3974           | 3.5992279 |
| 3909           | 3.5920657 | 3942           | 3.5957166 | 3975           | 3.5993371 |
| 3910           | 3.5921768 | 3943           | 3.5958268 | 3976           | 3.5994464 |
| 3911           | 3.5922878 | 3944           | 3.5959369 | 3977           | 3.5995556 |
| 3912           | 3.5923988 | 3945           | 3.5960470 | 3978           | 3.5996648 |
| 3913           | 3.5925098 | 3946           | 3.5961571 | 3979           | 3.5997739 |
| 3914           | 3.5926208 | 3947           | 3.5962671 | 3980           | 3.5998831 |
| 3915           | 3.5927318 | 3948           | 3.5963771 | 3981           | 3.5999922 |
| 3916           | 3.5928427 | 3949           | 3.5964871 | 3982           | 3.6001013 |
| 3917           | 3.5929530 | 3950           | 3.5965971 | 3983           | 3.6002103 |
| 3918           | 3.5930644 | 3951           | 3.5967070 | 3984           | 3.6003193 |
| 3919           | 3.5931753 | 3952           | 3.5968169 | 3985           | 3.6004283 |
| 3920           | 3.5932861 | 3953           | 3.5969268 | 3986           | 3.6005373 |
| 3921           | 3.5933968 | 3954           | 3.5970367 | 3987           | 3.6006462 |
| 3922           | 3.5935076 | 3955           | 3.5971465 | 3988           | 3.6007551 |
| 3923           | 3.5936183 | 3956           | 3.5972563 | 3989           | 3.6008640 |
| 3924           | 3.5937290 | 3957           | 3.5973661 | 3990           | 3.6009729 |
| 3925           | 3.5938397 | 3958           | 3.5974758 | 3991           | 3.6010817 |
| 3926           | 3.5939503 | 3959           | 3.5975855 | 3992           | 3.6011905 |
| 3927           | 3.5940609 | 3960           | 3.5976952 | 3993           | 3.6012993 |
| 3928           | 3.5941715 | 3961           | 3.5978048 | 3994           | 3.6014080 |
| 3929           | 3.5942820 | 3962           | 3.5979145 | 3995           | 3.6015168 |
| 3930           | 3.5943926 | 3963           | 3.5980241 | 3996           | 3.6016255 |
| 3931           | 3.5945030 | 3964           | 3.5981336 | 3997           | 3.6017341 |
| 3932           | 3.5946135 | 3965           | 3.5982432 | 3998           | 3.6018428 |
| 3933           | 3.5947239 | 3966           | 3.5983527 | 3999           | 3.6019514 |
| 3934           | 3.5948344 | 3967           | 3.5984622 | 4000           | 3.6020600 |

# 4000 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 4001           | 3.6021686 | 4034           | 3.6057359 | 4067           | 3.6092742 |
| 4002           | 3.6022771 | 4035           | 3.6058435 | 4068           | 3.6093809 |
| 4003           | 3.6023856 | 4036           | 3.6059512 | 4069           | 3.6094877 |
| 4004           | 3.6024941 | 4037           | 3.6060587 | 4070           | 3.6095944 |
| 4005           | 3.6026025 | 4038           | 3.6061663 | 4071           | 3.6097011 |
| 4006           | 3.6027109 | 4039           | 3.6062739 | 4072           | 3.6098078 |
| 4007           | 3.6028193 | 4040           | 3.6063814 | 4073           | 3.6099144 |
| 4008           | 3.6029277 | 4041           | 3.6064889 | 4074           | 3.6100210 |
| 4009           | 3.6030361 | 4042           | 3.6065963 | 4075           | 3.6101276 |
| 4010           | 3.6031444 | 4043           | 3.6067037 | 4076           | 3.6102342 |
| 4011           | 3.6032527 | 4044           | 3.6068111 | 4077           | 3.6103407 |
| 4012           | 3.6033609 | 4045           | 3.6069185 | 4078           | 3.6104472 |
| 4013           | 3.6034692 | 4046           | 3.6070259 | 4079           | 3.6105537 |
| 4014           | 3.6035774 | 4047           | 3.6071332 | 4080           | 3.6106602 |
| 4015           | 3.6036855 | 4048           | 3.6072405 | 4081           | 3.6107666 |
| 4016           | 3.6037937 | 4049           | 3.6073478 | 4082           | 3.6108730 |
| 4017           | 3.6039018 | 4050           | 3.6074550 | 4083           | 3.6109794 |
| 4018           | 3.6040099 | 4051           | 3.6075622 | 4084           | 3.6110857 |
| 4019           | 3.6041180 | 4052           | 3.6076694 | 4085           | 3.6111921 |
| 4020           | 3.6042261 | 4053           | 3.6077766 | 4086           | 3.6112984 |
| 4021           | 3.6043341 | 4054           | 3.6078837 | 4087           | 3.6114046 |
| 4022           | 3.6044421 | 4055           | 3.6079909 | 4088           | 3.6115109 |
| 4023           | 3.6045500 | 4056           | 3.6080979 | 4089           | 3.6116171 |
| 4024           | 3.6046580 | 4057           | 3.6082050 | 4090           | 3.6117233 |
| 4025           | 3.6047659 | 4058           | 3.6083120 | 4091           | 3.6118295 |
| 4026           | 3.6048738 | 4059           | 3.6084190 | 4092           | 3.6119356 |
| 4027           | 3.6049816 | 4060           | 3.6085260 | 4093           | 3.6120417 |
| 4028           | 3.6050895 | 4061           | 3.6086330 | 4094           | 3.6121478 |
| 4029           | 3.6051973 | 4062           | 3.6087399 | 4095           | 3.6122539 |
| 4030           | 3.6053050 | 4063           | 3.6088468 | 4096           | 3.6123599 |
| 4031           | 3.6054128 | 4064           | 3.6089537 | 4097           | 3.6124660 |
| 4032           | 3.6055205 | 4065           | 3.6090605 | 4098           | 3.6125720 |
| 4033           | 3.6056282 | 4066           | 3.6091674 | 4099           | 3.6126779 |
| 4034           | 3.6057359 | 4067           | 3.6092742 | 4100           | 3.6127839 |

4100



# 4100 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 4101           | 3.6128898 | 4134           | 3.6163705 | 4167           | 3.6198235 |
| 4102           | 3.6129957 | 4135           | 3.6164755 | 4168           | 3.6199277 |
| 4103           | 3.6131015 | 4136           | 3.6165805 | 4169           | 3.6200319 |
| 4104           | 3.6132074 | 4137           | 3.6166855 | 4170           | 3.6201361 |
| 4105           | 3.6133132 | 4138           | 3.6167905 | 4171           | 3.6202402 |
| 4106           | 3.6134189 | 4139           | 3.6168954 | 4172           | 3.6203443 |
| 4107           | 3.6135247 | 4140           | 3.6170003 | 4173           | 3.6204484 |
| 4108           | 3.6136304 | 4141           | 3.6171052 | 4174           | 3.6205524 |
| 4109           | 3.6137361 | 4142           | 3.6172101 | 4175           | 3.6206565 |
| 4110           | 3.6138418 | 4143           | 3.6173149 | 4176           | 3.6207605 |
| 4111           | 3.6139475 | 4144           | 3.6174197 | 4177           | 3.6208645 |
| 4112           | 3.6140531 | 4145           | 3.6175245 | 4178           | 3.6209684 |
| 4113           | 3.6141587 | 4146           | 3.6176293 | 4179           | 3.6210724 |
| 4114           | 3.6142643 | 4147           | 3.6177340 | 4180           | 3.6211763 |
| 4115           | 3.6143698 | 4148           | 3.6178387 | 4181           | 3.6212802 |
| 4116           | 3.6144754 | 4149           | 3.6179434 | 4182           | 3.6213840 |
| 4117           | 3.6145809 | 4150           | 3.6180481 | 4183           | 3.6214879 |
| 4118           | 3.6146863 | 4151           | 3.6181527 | 4184           | 3.6215917 |
| 4119           | 3.6147918 | 4152           | 3.6182573 | 4185           | 3.6216955 |
| 4120           | 3.6148972 | 4153           | 3.6183619 | 4186           | 3.6217992 |
| 4121           | 3.6150026 | 4154           | 3.6184665 | 4187           | 3.6219030 |
| 4122           | 3.6151080 | 4155           | 3.6185710 | 4188           | 3.6220067 |
| 4123           | 3.6152133 | 4156           | 3.6186755 | 4189           | 3.6221104 |
| 4124           | 3.6153187 | 4157           | 3.6187800 | 4190           | 3.6222140 |
| 4125           | 3.6154240 | 4158           | 3.6188845 | 4191           | 3.6223177 |
| 4126           | 3.6155292 | 4159           | 3.6189889 | 4192           | 3.6224213 |
| 4127           | 3.6156345 | 4160           | 3.6190933 | 4193           | 3.6225249 |
| 4128           | 3.6157397 | 4161           | 3.6191977 | 4194           | 3.6226284 |
| 4129           | 3.6158449 | 4162           | 3.6193021 | 4195           | 3.6227320 |
| 4130           | 3.6159501 | 4163           | 3.6194064 | 4196           | 3.6228355 |
| 4131           | 3.6160552 | 4164           | 3.6195107 | 4197           | 3.6229390 |
| 4132           | 3.6161603 | 4165           | 3.6196150 | 4198           | 3.6230424 |
| 4133           | 3.6162654 | 4166           | 3.6197193 | 4199           | 3.6231459 |
| 4134           | 3.6163705 | 4167           | 3.6198235 | 4200           | 3.6232493 |

# 4200 A TABLE of LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 4201           | 3.6233527 | 4234           | 3.6267509 | 4267           | 3.6301226 |
| 4202           | 3.6234560 | 4235           | 3.6268534 | 4268           | 3.6302244 |
| 4203           | 3.6235594 | 4236           | 3.6269560 | 4269           | 3.6303262 |
| 4204           | 3.6236627 | 4237           | 3.6270585 | 4270           | 3.6304279 |
| 4205           | 3.6237660 | 4238           | 3.6271610 | 4271           | 3.6305296 |
| 4206           | 3.6238693 | 4239           | 3.6272634 | 4272           | 3.6306312 |
| 4207           | 3.6239725 | 4240           | 3.6273659 | 4273           | 3.6307329 |
| 4208           | 3.6240757 | 4241           | 3.6274683 | 4274           | 3.6308345 |
| 4209           | 3.6241789 | 4242           | 3.6275707 | 4275           | 3.6309361 |
| 4210           | 3.6242821 | 4243           | 3.6276730 | 4276           | 3.6310377 |
| 4211           | 3.6243852 | 4244           | 3.6277754 | 4277           | 3.6311393 |
| 4212           | 3.6244884 | 4245           | 3.6278777 | 4278           | 3.6312408 |
| 4213           | 3.6245915 | 4246           | 3.6279800 | 4279           | 3.6313423 |
| 4214           | 3.6246945 | 4247           | 3.6280823 | 4280           | 3.6314438 |
| 4215           | 3.6247976 | 4248           | 3.6281845 | 4281           | 3.6315452 |
| 4216           | 3.6249006 | 4249           | 3.6282867 | 4282           | 3.6316467 |
| 4217           | 3.6250036 | 4250           | 3.6283889 | 4283           | 3.6317481 |
| 4218           | 3.6251066 | 4251           | 3.6284911 | 4284           | 3.6318495 |
| 4219           | 3.6252095 | 4252           | 3.6285933 | 4285           | 3.6319508 |
| 4220           | 3.6253125 | 4253           | 3.6286954 | 4286           | 3.6320522 |
| 4221           | 3.6254154 | 4254           | 3.6287975 | 4287           | 3.6321535 |
| 4222           | 3.6255182 | 4255           | 3.6288996 | 4288           | 3.6322548 |
| 4223           | 3.6256211 | 4256           | 3.6290016 | 4289           | 3.6323560 |
| 4224           | 3.6257239 | 4257           | 3.6291037 | 4290           | 3.6324573 |
| 4225           | 3.6258267 | 4258           | 3.6292057 | 4291           | 3.6325585 |
| 4226           | 3.6259295 | 4259           | 3.6293076 | 4292           | 3.6326597 |
| 4227           | 3.6260322 | 4260           | 3.6294096 | 4293           | 3.6327609 |
| 4228           | 3.6261350 | 4261           | 3.6295115 | 4294           | 3.6328620 |
| 4229           | 3.6262377 | 4262           | 3.6296134 | 4295           | 3.6329632 |
| 4230           | 3.6263404 | 4263           | 3.6297153 | 4296           | 3.6330643 |
| 4231           | 3.6264430 | 4264           | 3.6298172 | 4297           | 3.6331654 |
| 4232           | 3.6265457 | 4265           | 3.6299190 | 4298           | 3.6332664 |
| 4233           | 3.6266483 | 4266           | 3.6300209 | 4299           | 3.6333674 |
| 4234           | 3.6267509 | 4267           | 3.6301226 | 4300           | 3.6334685 |

# 4300 A TABLE of LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 4301           | 3.6335694 | 4334           | 3.6368889 | 4367           | 3.6401832 |
| 4302           | 3.6336704 | 4335           | 3.6369891 | 4368           | 3.6402826 |
| 4303           | 3.6337713 | 4336           | 3.6370893 | 4369           | 3.6403820 |
| 4304           | 3.6338723 | 4337           | 3.6371894 | 4370           | 3.6404814 |
| 4305           | 3.6339732 | 4338           | 3.6372895 | 4371           | 3.6405808 |
| 4306           | 3.6340740 | 4339           | 3.6373897 | 4372           | 3.6406802 |
| 4307           | 3.6341749 | 4340           | 3.6374897 | 4373           | 3.6407795 |
| 4308           | 3.6342757 | 4341           | 3.6375898 | 4374           | 3.6408788 |
| 4309           | 3.6343765 | 4342           | 3.6376898 | 4375           | 3.6409781 |
| 4310           | 3.6344773 | 4343           | 3.6377898 | 4376           | 3.6410773 |
| 4311           | 3.6345780 | 4344           | 3.6378898 | 4377           | 3.6411765 |
| 4312           | 3.6346788 | 4345           | 3.6379898 | 4378           | 3.6412758 |
| 4313           | 3.6347795 | 4346           | 3.6380897 | 4379           | 3.6413749 |
| 4314           | 3.6348801 | 4347           | 3.6381896 | 4380           | 3.6414741 |
| 4315           | 3.6349808 | 4348           | 3.6382895 | 4381           | 3.6415733 |
| 4316           | 3.6350814 | 4349           | 3.6383894 | 4382           | 3.6416724 |
| 4317           | 3.6351820 | 4350           | 3.6384893 | 4383           | 3.6417715 |
| 4318           | 3.6352826 | 4351           | 3.6385891 | 4384           | 3.6418705 |
| 4319           | 3.6353832 | 4352           | 3.6386889 | 4385           | 3.6419696 |
| 4320           | 3.6354837 | 4353           | 3.6387887 | 4386           | 3.6420686 |
| 4321           | 3.6355843 | 4354           | 3.6388884 | 4387           | 3.6421676 |
| 4322           | 3.6356848 | 4355           | 3.6389882 | 4388           | 3.6422666 |
| 4323           | 3.6357852 | 4356           | 3.6390879 | 4389           | 3.6423656 |
| 4324           | 3.6358857 | 4357           | 3.6391876 | 4390           | 3.6424645 |
| 4325           | 3.6359861 | 4358           | 3.6392872 | 4391           | 3.6425634 |
| 4326           | 3.6360865 | 4359           | 3.6393869 | 4392           | 3.6426623 |
| 4327           | 3.6361869 | 4360           | 3.6394865 | 4393           | 3.6427612 |
| 4328           | 3.6362873 | 4361           | 3.6395861 | 4394           | 3.6428601 |
| 4329           | 3.6363876 | 4362           | 3.6396857 | 4395           | 3.6429589 |
| 4330           | 3.6364879 | 4363           | 3.6397852 | 4396           | 3.6430577 |
| 4331           | 3.6365882 | 4364           | 3.6398847 | 4397           | 3.6431565 |
| 4332           | 3.6366884 | 4365           | 3.6399842 | 4398           | 3.6432552 |
| 4333           | 3.6367887 | 4366           | 3.6400837 | 4399           | 3.6433540 |
| 4334           | 3.6368889 | 4367           | 3.6401832 | 4400           | 3.6434527 |



# 4400 A TABLE of LOGARITHMS. 0024

| N <sup>o</sup> . | Logarith. | N <sup>o</sup> . | Logarith. | N <sup>o</sup> . | Logarith. |
|------------------|-----------|------------------|-----------|------------------|-----------|
| 4401             | 3.6435514 | 4434             | 3.6467957 | 4467             | 3.6500160 |
| 4402             | 3.6436560 | 4435             | 3.6468936 | 4468             | 3.6501132 |
| 4403             | 3.6437487 | 4436             | 3.6469915 | 4469             | 3.6502104 |
| 4404             | 3.6438473 | 4437             | 3.6470894 | 4470             | 3.6503075 |
| 4405             | 3.6439459 | 4438             | 3.6471873 | 4471             | 3.6504047 |
| 4406             | 3.6440445 | 4439             | 3.6472851 | 4472             | 3.6505018 |
| 4407             | 3.6441431 | 4440             | 3.6473830 | 4473             | 3.6505989 |
| 4408             | 3.6442416 | 4441             | 3.6474808 | 4474             | 3.6506960 |
| 4409             | 3.6443401 | 4442             | 3.6475785 | 4475             | 3.6507930 |
| 4410             | 3.6444386 | 4443             | 3.6476763 | 4476             | 3.6508901 |
| 4411             | 3.6445371 | 4444             | 3.6477741 | 4477             | 3.6509871 |
| 4412             | 3.6446355 | 4445             | 3.6478718 | 4478             | 3.6510841 |
| 4413             | 3.6447339 | 4446             | 3.6479695 | 4479             | 3.6511811 |
| 4414             | 3.6448323 | 4447             | 3.6480671 | 4480             | 3.6512780 |
| 4415             | 3.6449307 | 4448             | 3.6481648 | 4481             | 3.6513749 |
| 4416             | 3.6450291 | 4449             | 3.6482624 | 4482             | 3.6514719 |
| 4417             | 3.6451274 | 4450             | 3.6483600 | 4483             | 3.6515687 |
| 4418             | 3.6452257 | 4451             | 3.6484576 | 4484             | 3.6516656 |
| 4419             | 3.6453240 | 4452             | 3.6485552 | 4485             | 3.6517624 |
| 4420             | 3.6454223 | 4453             | 3.6486527 | 4486             | 3.6518593 |
| 4421             | 3.6455205 | 4454             | 3.6487502 | 4487             | 3.6519561 |
| 4422             | 3.6456187 | 4455             | 3.6488477 | 4488             | 3.6520528 |
| 4423             | 3.6457169 | 4456             | 3.6489452 | 4489             | 3.6521496 |
| 4424             | 3.6458151 | 4457             | 3.6490426 | 4490             | 3.6522463 |
| 4425             | 3.6459133 | 4458             | 3.6491401 | 4491             | 3.6523431 |
| 4426             | 3.6460114 | 4459             | 3.6492375 | 4492             | 3.6524397 |
| 4427             | 3.6461095 | 4460             | 3.6493349 | 4493             | 3.6525364 |
| 4428             | 3.6462076 | 4461             | 3.6494322 | 4494             | 3.6526331 |
| 4429             | 3.6463057 | 4462             | 3.6495296 | 4495             | 3.6527297 |
| 4430             | 3.6464037 | 4463             | 3.6496269 | 4496             | 3.6528263 |
| 4431             | 3.6465018 | 4464             | 3.6497242 | 4497             | 3.6529229 |
| 4432             | 3.6465998 | 4465             | 3.6498215 | 4498             | 3.6530195 |
| 4433             | 3.6466977 | 4466             | 3.6499187 | 4499             | 3.6531160 |
| 4434             | 3.6467957 | 4467             | 3.6500160 | 4500             | 3.6532125 |

# 4500 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 4501           | 3.6533090 | 4534           | 3.6564815 | 4567           | 3.6596310 |
| 4502           | 3.6534055 | 4535           | 3.6565773 | 4568           | 3.6597261 |
| 4503           | 3.6535019 | 4536           | 3.6566730 | 4569           | 3.6598212 |
| 4504           | 3.6535984 | 4537           | 3.6567688 | 4570           | 3.6599162 |
| 4505           | 3.6536948 | 4538           | 3.6568645 | 4571           | 3.6600112 |
| 4506           | 3.6537912 | 4539           | 3.6569602 | 4572           | 3.6601062 |
| 4507           | 3.6538876 | 4540           | 3.6570559 | 4573           | 3.6602012 |
| 4508           | 3.6539839 | 4541           | 3.6571515 | 4574           | 3.6602962 |
| 4509           | 3.6540802 | 4542           | 3.6572471 | 4575           | 3.6603911 |
| 4510           | 3.6541765 | 4543           | 3.6573427 | 4576           | 3.6604860 |
| 4511           | 3.6542728 | 4544           | 3.6574383 | 4577           | 3.6605809 |
| 4512           | 3.6543691 | 4545           | 3.6575339 | 4578           | 3.6606758 |
| 4513           | 3.6544653 | 4546           | 3.6576294 | 4579           | 3.6607706 |
| 4514           | 3.6545616 | 4547           | 3.6577250 | 4580           | 3.6608655 |
| 4515           | 3.6546578 | 4548           | 3.6578205 | 4581           | 3.6609603 |
| 4516           | 3.6547539 | 4549           | 3.6579159 | 4582           | 3.6610551 |
| 4517           | 3.6548501 | 4550           | 3.6580114 | 4583           | 3.6611499 |
| 4518           | 3.6549462 | 4551           | 3.6581068 | 4584           | 3.6612446 |
| 4519           | 3.6550423 | 4552           | 3.6582023 | 4585           | 3.6613393 |
| 4520           | 3.6551384 | 4553           | 3.6582977 | 4586           | 3.6614341 |
| 4521           | 3.6552345 | 4554           | 3.6583930 | 4587           | 3.6615287 |
| 4522           | 3.6553306 | 4555           | 3.6584884 | 4588           | 3.6616234 |
| 4523           | 3.6554266 | 4556           | 3.6585837 | 4589           | 3.6617181 |
| 4524           | 3.6555226 | 4557           | 3.6586790 | 4590           | 3.6618127 |
| 4525           | 3.6556186 | 4558           | 3.6587743 | 4591           | 3.6619073 |
| 4526           | 3.6557145 | 4559           | 3.6588696 | 4592           | 3.6620019 |
| 4527           | 3.6558105 | 4560           | 3.6589648 | 4593           | 3.6620964 |
| 4528           | 3.6559064 | 4561           | 3.6590601 | 4594           | 3.6621910 |
| 4529           | 3.6560023 | 4562           | 3.6591553 | 4595           | 3.6622855 |
| 4530           | 3.6560982 | 4563           | 3.6592505 | 4596           | 3.6623800 |
| 4531           | 3.6561941 | 4564           | 3.6593456 | 4597           | 3.6624745 |
| 4532           | 3.6562899 | 4565           | 3.6594408 | 4598           | 3.6625690 |
| 4533           | 3.6563857 | 4566           | 3.6595359 | 4599           | 3.6626634 |
| 4534           | 3.6564815 | 4567           | 3.6596310 | 4600           | 3.6627578 |

# 4600 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 4601           | 3.6628522 | 4634           | 3.6659560 | 4667           | 3.6690378 |
| 4602           | 3.6629466 | 4635           | 3.6660497 | 4668           | 3.6691308 |
| 4603           | 3.6630410 | 4636           | 3.6661434 | 4669           | 3.6692239 |
| 4604           | 3.6631353 | 4637           | 3.6662371 | 4670           | 3.6693169 |
| 4605           | 3.6632296 | 4638           | 3.6663307 | 4671           | 3.6694099 |
| 4606           | 3.6633239 | 4639           | 3.6664244 | 4672           | 3.6695028 |
| 4607           | 3.6634182 | 4640           | 3.6665180 | 4673           | 3.6695958 |
| 4608           | 3.6635125 | 4641           | 3.6666116 | 4674           | 3.6696887 |
| 4609           | 3.6636067 | 4642           | 3.6667051 | 4675           | 3.6697816 |
| 4610           | 3.6637009 | 4643           | 3.6667987 | 4676           | 3.6698745 |
| 4611           | 3.6637951 | 4644           | 3.6668922 | 4677           | 3.6699674 |
| 4612           | 3.6638893 | 4645           | 3.6669857 | 4678           | 3.6700602 |
| 4613           | 3.6639835 | 4646           | 3.6670792 | 4679           | 3.6701530 |
| 4614           | 3.6640776 | 4647           | 3.6671727 | 4680           | 3.6702459 |
| 4615           | 3.6641717 | 4648           | 3.6672661 | 4681           | 3.6703386 |
| 4616           | 3.6642658 | 4649           | 3.6673595 | 4682           | 3.6704314 |
| 4617           | 3.6643599 | 4650           | 3.6674530 | 4683           | 3.6705242 |
| 4618           | 3.6644539 | 4651           | 3.6675463 | 4684           | 3.6706169 |
| 4619           | 3.6645480 | 4652           | 3.6676397 | 4685           | 3.6707096 |
| 4620           | 3.6646420 | 4653           | 3.6677331 | 4686           | 3.6708023 |
| 4621           | 3.6647360 | 4654           | 3.6678264 | 4687           | 3.6708950 |
| 4622           | 3.6648299 | 4655           | 3.6679197 | 4688           | 3.6709876 |
| 4623           | 3.6649239 | 4656           | 3.6680130 | 4689           | 3.6710802 |
| 4624           | 3.6650178 | 4657           | 3.6681062 | 4690           | 3.6711728 |
| 4625           | 3.6651117 | 4658           | 3.6681995 | 4691           | 3.6712654 |
| 4626           | 3.6652056 | 4659           | 3.6682927 | 4692           | 3.6713580 |
| 4627           | 3.6652995 | 4660           | 3.6683859 | 4693           | 3.6714506 |
| 4628           | 3.6653934 | 4661           | 3.6684791 | 4694           | 3.6715431 |
| 4629           | 3.6654872 | 4662           | 3.6685723 | 4695           | 3.6716356 |
| 4630           | 3.6655810 | 4663           | 3.6686654 | 4696           | 3.6717281 |
| 4631           | 3.6656748 | 4664           | 3.6687585 | 4697           | 3.6718206 |
| 4632           | 3.6657686 | 4665           | 3.6688516 | 4698           | 3.6719130 |
| 4633           | 3.6658623 | 4666           | 3.6689447 | 4699           | 3.6720054 |
| 4634           | 3.6659560 | 4667           | 3.6690378 | 4700           | 3.6720979 |



# 4700. A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 4701           | 3.6721903 | 4734           | 3.6752283 | 4767           | 3.6782452 |
| 4702           | 3.6722826 | 4735           | 3.6753200 | 4768           | 3.6783362 |
| 4703           | 3.6723750 | 4736           | 3.6754117 | 4769           | 3.6784273 |
| 4704           | 3.6724673 | 4737           | 3.6755034 | 4770           | 3.6785184 |
| 4705           | 3.6725596 | 4738           | 3.6755951 | 4771           | 3.6786094 |
| 4706           | 3.6726519 | 4739           | 3.6756867 | 4772           | 3.6787004 |
| 4707           | 3.6727442 | 4740           | 3.6757783 | 4773           | 3.6787914 |
| 4708           | 3.6728365 | 4741           | 3.6758700 | 4774           | 3.6788824 |
| 4709           | 3.6729287 | 4742           | 3.6759615 | 4775           | 3.6789734 |
| 4710           | 3.6730209 | 4743           | 3.6760531 | 4776           | 3.6790643 |
| 4711           | 3.6731131 | 4744           | 3.6761447 | 4777           | 3.6791552 |
| 4712           | 3.6732053 | 4745           | 3.6762362 | 4778           | 3.6792461 |
| 4713           | 3.6732974 | 4746           | 3.6763277 | 4779           | 3.6793370 |
| 4714           | 3.6733896 | 4747           | 3.6764192 | 4780           | 3.6794279 |
| 4715           | 3.6734817 | 4748           | 3.6765107 | 4781           | 3.6795187 |
| 4716           | 3.6735738 | 4749           | 3.6766022 | 4782           | 3.6796096 |
| 4717           | 3.6736659 | 4750           | 3.6766936 | 4783           | 3.6797004 |
| 4718           | 3.6737579 | 4751           | 3.6767850 | 4784           | 3.6797912 |
| 4719           | 3.6738500 | 4752           | 3.6768764 | 4785           | 3.6798819 |
| 4720           | 3.6739420 | 4753           | 3.6769678 | 4786           | 3.6799727 |
| 4721           | 3.6740340 | 4754           | 3.6770592 | 4787           | 3.6800634 |
| 4722           | 3.6741260 | 4755           | 3.6771503 | 4788           | 3.6801541 |
| 4723           | 3.6742179 | 4756           | 3.6772418 | 4789           | 3.6802448 |
| 4724           | 3.6743099 | 4757           | 3.6773332 | 4790           | 3.6803355 |
| 4725           | 3.6744018 | 4758           | 3.6774244 | 4791           | 3.6804262 |
| 4726           | 3.6744937 | 4759           | 3.6775157 | 4792           | 3.6805168 |
| 4727           | 3.6745856 | 4760           | 3.6776070 | 4793           | 3.6806074 |
| 4728           | 3.6746775 | 4761           | 3.6776982 | 4794           | 3.6806980 |
| 4729           | 3.6747693 | 4762           | 3.6777894 | 4795           | 3.6807886 |
| 4730           | 3.6748611 | 4763           | 3.6778806 | 4796           | 3.6808792 |
| 4731           | 3.6749529 | 4764           | 3.6779718 | 4797           | 3.6809697 |
| 4732           | 3.6750447 | 4765           | 3.6780629 | 4798           | 3.6810602 |
| 4733           | 3.6751365 | 4766           | 3.6781540 | 4799           | 3.6811507 |
| 4734           | 3.6752283 | 4767           | 3.6782452 | 4800           | 3.6812412 |

# 4800 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 4801           | 3.6813317 | 4834           | 3.6843066 | 4867           | 3.6872613 |
| 4802           | 3.6814222 | 4835           | 3.6843965 | 4868           | 3.6873506 |
| 4803           | 3.6815126 | 4836           | 3.6844863 | 4869           | 3.6874398 |
| 4804           | 3.6816030 | 4837           | 3.6845761 | 4870           | 3.6875290 |
| 4805           | 3.6816934 | 4838           | 3.6846659 | 4871           | 3.6876181 |
| 4806           | 3.6817838 | 4839           | 3.6847556 | 4872           | 3.6877073 |
| 4807           | 3.6818741 | 4840           | 3.6848454 | 4873           | 3.6877964 |
| 4808           | 3.6819645 | 4841           | 3.6849351 | 4874           | 3.6878855 |
| 4809           | 3.6820548 | 4842           | 3.6850248 | 4875           | 3.6879746 |
| 4810           | 3.6821451 | 4843           | 3.6851145 | 4876           | 3.6880637 |
| 4811           | 3.6822354 | 4844           | 3.6852041 | 4877           | 3.6881528 |
| 4812           | 3.6823256 | 4845           | 3.6852938 | 4878           | 3.6882418 |
| 4813           | 3.6824159 | 4846           | 3.6853834 | 4879           | 3.6883308 |
| 4814           | 3.6825061 | 4847           | 3.6854730 | 4880           | 3.6884198 |
| 4815           | 3.6825963 | 4848           | 3.6855626 | 4881           | 3.6885088 |
| 4816           | 3.6826865 | 4849           | 3.6856522 | 4882           | 3.6885978 |
| 4817           | 3.6827766 | 4850           | 3.6857417 | 4883           | 3.6886867 |
| 4818           | 3.6828668 | 4851           | 3.6858313 | 4884           | 3.6887757 |
| 4819           | 3.6829569 | 4852           | 3.6859208 | 4885           | 3.6888646 |
| 4820           | 3.6830470 | 4853           | 3.6860103 | 4886           | 3.6889535 |
| 4821           | 3.6831371 | 4854           | 3.6860998 | 4887           | 3.6890423 |
| 4822           | 3.6832272 | 4855           | 3.6861892 | 4888           | 3.6891312 |
| 4823           | 3.6833173 | 4856           | 3.6862787 | 4889           | 3.6892200 |
| 4824           | 3.6834073 | 4857           | 3.6863681 | 4890           | 3.6893089 |
| 4825           | 3.6834973 | 4858           | 3.6864575 | 4891           | 3.6893977 |
| 4826           | 3.6835873 | 4859           | 3.6865469 | 4892           | 3.6894864 |
| 4827           | 3.6836773 | 4860           | 3.6866363 | 4893           | 3.6895752 |
| 4828           | 3.6837673 | 4861           | 3.6867256 | 4894           | 3.6896640 |
| 4829           | 3.6838572 | 4862           | 3.6868150 | 4895           | 3.6897527 |
| 4830           | 3.6839471 | 4863           | 3.6869043 | 4896           | 3.6898414 |
| 4831           | 3.6840370 | 4864           | 3.6869936 | 4897           | 3.6899301 |
| 4832           | 3.6841269 | 4865           | 3.6870828 | 4898           | 3.6900188 |
| 4833           | 3.6842168 | 4866           | 3.6871721 | 4899           | 3.6901074 |
| 4834           | 3.6843066 | 4867           | 3.6872613 | 4900           | 3.6901961 |

# 4900 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 4901           | 3.6962847 | 4934           | 3.6931991 | 4967           | 3.6960942 |
| 4902           | 3.6963733 | 4935           | 3.6932872 | 4968           | 3.6961816 |
| 4903           | 3.6964619 | 4936           | 3.6933752 | 4969           | 3.6962690 |
| 4904           | 3.6965505 | 4937           | 3.6934631 | 4970           | 3.6963564 |
| 4905           | 3.6966390 | 4938           | 3.6935511 | 4971           | 3.6964438 |
| 4906           | 3.6967275 | 4939           | 3.6936390 | 4972           | 3.6965311 |
| 4907           | 3.6968161 | 4940           | 3.6937269 | 4973           | 3.6966185 |
| 4908           | 3.6969046 | 4941           | 3.6938149 | 4974           | 3.6967058 |
| 4909           | 3.6969930 | 4942           | 3.6939027 | 4975           | 3.6967931 |
| 4910           | 3.6970815 | 4943           | 3.6939906 | 4976           | 3.6968804 |
| 4911           | 3.6971699 | 4944           | 3.6940785 | 4977           | 3.6969676 |
| 4912           | 3.6972584 | 4945           | 3.6941663 | 4978           | 3.6970549 |
| 4913           | 3.6973468 | 4946           | 3.6942541 | 4979           | 3.6971421 |
| 4914           | 3.6974352 | 4947           | 3.6943419 | 4980           | 3.6972293 |
| 4915           | 3.6975235 | 4948           | 3.6944297 | 4981           | 3.6973165 |
| 4916           | 3.6976119 | 4949           | 3.6945174 | 4982           | 3.6974037 |
| 4917           | 3.6977002 | 4950           | 3.6946052 | 4983           | 3.6974909 |
| 4918           | 3.6977885 | 4951           | 3.6946929 | 4984           | 3.6975780 |
| 4919           | 3.6978768 | 4952           | 3.6947806 | 4985           | 3.6976652 |
| 4920           | 3.6979651 | 4953           | 3.6948683 | 4986           | 3.6977523 |
| 4921           | 3.6920534 | 4954           | 3.6949560 | 4987           | 3.6978394 |
| 4922           | 3.6921416 | 4955           | 3.6950437 | 4988           | 3.6979264 |
| 4923           | 3.6922298 | 4956           | 3.6951313 | 4989           | 3.6980135 |
| 4924           | 3.6923180 | 4957           | 3.6952189 | 4990           | 3.6981005 |
| 4925           | 3.6924062 | 4958           | 3.6953065 | 4991           | 3.6981876 |
| 4926           | 3.6924944 | 4959           | 3.6953941 | 4992           | 3.6982746 |
| 4927           | 3.6925826 | 4960           | 3.6954817 | 4993           | 3.6983616 |
| 4928           | 3.6926707 | 4961           | 3.6955692 | 4994           | 3.6984485 |
| 4929           | 3.6927588 | 4962           | 3.6956568 | 4995           | 3.6985355 |
| 4930           | 3.6928469 | 4963           | 3.6957443 | 4996           | 3.6986224 |
| 4931           | 3.6929350 | 4964           | 3.6958318 | 4997           | 3.6987093 |
| 4932           | 3.6930231 | 4965           | 3.6959193 | 4998           | 3.6987963 |
| 4933           | 3.6931111 | 4966           | 3.6960067 | 4999           | 3.6988831 |
| 4934           | 3.6931991 | 4967           | 3.6960942 | 5000           | 3.6989700 |



# 5000 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 5001           | 3.6990569 | 5034           | 3.7019132 | 5067           | 3.7047509 |
| 5002           | 3.6991437 | 5035           | 3.7019995 | 5068           | 3.7048366 |
| 5003           | 3.6992305 | 5036           | 3.7020857 | 5069           | 3.7049223 |
| 5004           | 3.6993173 | 5037           | 3.7021720 | 5070           | 3.7050080 |
| 5005           | 3.6994041 | 5038           | 3.7022582 | 5071           | 3.7050936 |
| 5006           | 3.6994908 | 5039           | 3.7023444 | 5072           | 3.7051792 |
| 5007           | 3.6995776 | 5040           | 3.7024305 | 5073           | 3.7052649 |
| 5008           | 3.6996643 | 5041           | 3.7025167 | 5074           | 3.7053505 |
| 5009           | 3.6997510 | 5042           | 3.7026028 | 5075           | 3.7054360 |
| 5010           | 3.6998377 | 5043           | 3.7026890 | 5076           | 3.7055216 |
| 5011           | 3.6999244 | 5044           | 3.7027751 | 5077           | 3.7056072 |
| 5012           | 3.7000111 | 5045           | 3.7028612 | 5078           | 3.7056927 |
| 5013           | 3.7000977 | 5046           | 3.7029472 | 5079           | 3.7057782 |
| 5014           | 3.7001843 | 5047           | 3.7030333 | 5080           | 3.7058637 |
| 5015           | 3.7002709 | 5048           | 3.7031193 | 5081           | 3.7059492 |
| 5016           | 3.7003575 | 5049           | 3.7032054 | 5082           | 3.7060347 |
| 5017           | 3.7004441 | 5050           | 3.7032914 | 5083           | 3.7061201 |
| 5018           | 3.7005307 | 5051           | 3.7033774 | 5084           | 3.7062055 |
| 5019           | 3.7006172 | 5052           | 3.7034633 | 5085           | 3.7062910 |
| 5020           | 3.7007037 | 5053           | 3.7035493 | 5086           | 3.7063764 |
| 5021           | 3.7007902 | 5054           | 3.7036352 | 5087           | 3.7064617 |
| 5022           | 3.7008767 | 5055           | 3.7037212 | 5088           | 3.7065471 |
| 5023           | 3.7009632 | 5056           | 3.7038071 | 5089           | 3.7066325 |
| 5024           | 3.7010496 | 5057           | 3.7038930 | 5090           | 3.7067178 |
| 5025           | 3.7011361 | 5058           | 3.7039788 | 5091           | 3.7068031 |
| 5026           | 3.7012225 | 5059           | 3.7040647 | 5092           | 3.7068884 |
| 5027           | 3.7013089 | 5060           | 3.7041505 | 5093           | 3.7069737 |
| 5028           | 3.7013953 | 5061           | 3.7042363 | 5094           | 3.7070589 |
| 5029           | 3.7014816 | 5062           | 3.7043221 | 5095           | 3.7071442 |
| 5030           | 3.7015680 | 5063           | 3.7044079 | 5096           | 3.7072294 |
| 5031           | 3.7016543 | 5064           | 3.7044937 | 5097           | 3.7073146 |
| 5032           | 3.7017406 | 5065           | 3.7045794 | 5098           | 3.7073998 |
| 5033           | 3.7018269 | 5066           | 3.7046652 | 5099           | 3.7074850 |
| 5034           | 3.7019132 | 5067           | 3.7047509 | 5100           | 3.7075702 |

5100

# 5100 A TABLE of LOGARITHMS. 0007

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 5101           | 3.7076553 | 5134           | 3.7104559 | 5167           | 3.7132385 |
| 5102           | 3.7077405 | 5135           | 3.7105404 | 5168           | 3.7133225 |
| 5103           | 3.7078256 | 5136           | 3.7106250 | 5169           | 3.7134065 |
| 5104           | 3.7079107 | 5137           | 3.7107096 | 5170           | 3.7134905 |
| 5105           | 3.7079957 | 5138           | 3.7107941 | 5171           | 3.7135745 |
| 5106           | 3.7080808 | 5139           | 3.7108786 | 5172           | 3.7136585 |
| 5107           | 3.7081659 | 5140           | 3.7109631 | 5173           | 3.7137425 |
| 5108           | 3.7082509 | 5141           | 3.7110476 | 5174           | 3.7138264 |
| 5109           | 3.7083359 | 5142           | 3.7111321 | 5175           | 3.7139104 |
| 5110           | 3.7084209 | 5143           | 3.7112165 | 5176           | 3.7139943 |
| 5111           | 3.7085059 | 5144           | 3.7113010 | 5177           | 3.7140782 |
| 5112           | 3.7085908 | 5145           | 3.7113854 | 5178           | 3.7141622 |
| 5113           | 3.7086758 | 5146           | 3.7114698 | 5179           | 3.7142460 |
| 5114           | 3.7087607 | 5147           | 3.7115542 | 5180           | 3.7143298 |
| 5115           | 3.7088456 | 5148           | 3.7116385 | 5181           | 3.7144136 |
| 5116           | 3.7089305 | 5149           | 3.7117229 | 5182           | 3.7144974 |
| 5117           | 3.7090154 | 5150           | 3.7118072 | 5183           | 3.7145812 |
| 5118           | 3.7091003 | 5151           | 3.7118915 | 5184           | 3.7146650 |
| 5119           | 3.7091851 | 5152           | 3.7119759 | 5185           | 3.7147488 |
| 5120           | 3.7092700 | 5153           | 3.7120601 | 5186           | 3.7148325 |
| 5121           | 3.7093548 | 5154           | 3.7121444 | 5187           | 3.7149162 |
| 5122           | 3.7094396 | 5155           | 3.7122287 | 5188           | 3.7150000 |
| 5123           | 3.7095244 | 5156           | 3.7123129 | 5189           | 3.7150837 |
| 5124           | 3.7096091 | 5157           | 3.7123971 | 5190           | 3.7151674 |
| 5125           | 3.7096939 | 5158           | 3.7124813 | 5191           | 3.7152510 |
| 5126           | 3.7097786 | 5159           | 3.7125655 | 5192           | 3.7153347 |
| 5127           | 3.7098633 | 5160           | 3.7126497 | 5193           | 3.7154183 |
| 5128           | 3.7099480 | 5161           | 3.7127339 | 5194           | 3.7155019 |
| 5129           | 3.7100327 | 5162           | 3.7128180 | 5195           | 3.7155856 |
| 5130           | 3.7101174 | 5163           | 3.7129021 | 5196           | 3.7156691 |
| 5131           | 3.7102020 | 5164           | 3.7129862 | 5197           | 3.7157527 |
| 5132           | 3.7102866 | 5165           | 3.7130703 | 5198           | 3.7158363 |
| 5133           | 3.7103713 | 5166           | 3.7131544 | 5199           | 3.7159198 |
| 5134           | 3.7104559 | 5167           | 3.7132385 | 5200           | 3.7160033 |

# 5200 A TABLE of LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 5201           | 3.7160869 | 5234           | 3.7188337 | 5267           | 3.7215633 |
| 5202           | 3.7161703 | 5235           | 3.7189167 | 5268           | 3.7216458 |
| 5203           | 3.7162538 | 5236           | 3.7189996 | 5269           | 3.7217282 |
| 5204           | 3.7163373 | 5237           | 3.7190826 | 5270           | 3.7218106 |
| 5205           | 3.7164207 | 5238           | 3.7191655 | 5271           | 3.7218930 |
| 5206           | 3.7165042 | 5239           | 3.7192484 | 5272           | 3.7219754 |
| 5207           | 3.7165876 | 5240           | 3.7193313 | 5273           | 3.7220578 |
| 5208           | 3.7166710 | 5241           | 3.7194142 | 5274           | 3.7221401 |
| 5209           | 3.7167544 | 5242           | 3.7194970 | 5275           | 3.7222225 |
| 5210           | 3.7168377 | 5243           | 3.7195799 | 5276           | 3.7223048 |
| 5211           | 3.7169211 | 5244           | 3.7196627 | 5277           | 3.7223871 |
| 5212           | 3.7170044 | 5245           | 3.7197455 | 5278           | 3.7224694 |
| 5213           | 3.7170877 | 5246           | 3.7198283 | 5279           | 3.7225517 |
| 5214           | 3.7171710 | 5247           | 3.7199111 | 5280           | 3.7226339 |
| 5215           | 3.7172543 | 5248           | 3.7199938 | 5281           | 3.7227162 |
| 5216           | 3.7173376 | 5249           | 3.7200766 | 5282           | 3.7227984 |
| 5217           | 3.7174208 | 5250           | 3.7201593 | 5283           | 3.7228806 |
| 5218           | 3.7175041 | 5251           | 3.7202420 | 5284           | 3.7229628 |
| 5219           | 3.7175873 | 5252           | 3.7203247 | 5285           | 3.7230450 |
| 5220           | 3.7176705 | 5253           | 3.7204074 | 5286           | 3.7231272 |
| 5221           | 3.7177537 | 5254           | 3.7204901 | 5287           | 3.7232093 |
| 5222           | 3.7178369 | 5255           | 3.7205727 | 5288           | 3.7232914 |
| 5223           | 3.7179200 | 5256           | 3.7206554 | 5289           | 3.7233736 |
| 5224           | 3.7180032 | 5257           | 3.7207380 | 5290           | 3.7234557 |
| 5225           | 3.7180863 | 5258           | 3.7208206 | 5291           | 3.7235378 |
| 5226           | 3.7181694 | 5259           | 3.7209032 | 5292           | 3.7236198 |
| 5227           | 3.7182525 | 5260           | 3.7209857 | 5293           | 3.7237019 |
| 5228           | 3.7183356 | 5261           | 3.7210683 | 5294           | 3.7237839 |
| 5229           | 3.7184186 | 5262           | 3.7211508 | 5295           | 3.7238660 |
| 5230           | 3.7185017 | 5263           | 3.7212334 | 5296           | 3.7239480 |
| 5231           | 3.7185847 | 5264           | 3.7213159 | 5297           | 3.7240300 |
| 5232           | 3.7186677 | 5265           | 3.7213984 | 5298           | 3.7241120 |
| 5233           | 3.7187507 | 5266           | 3.7214809 | 5299           | 3.7241939 |
| 5234           | 3.7188337 | 5267           | 3.7215633 | 5300           | 3.7242759 |
| H              |           |                |           | 5300           |           |



# 5300 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith  |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 5301           | 3.7243578 | 5334           | 3.7270530 | 5367           | 3.7297316 |
| 5302           | 3.7244397 | 5335           | 3.7271344 | 5368           | 3.7298125 |
| 5303           | 3.7245216 | 5336           | 3.7272158 | 5369           | 3.7298934 |
| 5304           | 3.7246035 | 5337           | 3.7272972 | 5370           | 3.7299743 |
| 5305           | 3.7246854 | 5338           | 3.7273786 | 5371           | 3.7300552 |
| 5306           | 3.7247672 | 5339           | 3.7274599 | 5372           | 3.7301360 |
| 5307           | 3.7248491 | 5340           | 3.7275413 | 5373           | 3.7302168 |
| 5308           | 3.7249309 | 5341           | 3.7276226 | 5374           | 3.7302977 |
| 5309           | 3.7250127 | 5342           | 3.7277039 | 5375           | 3.7303785 |
| 5310           | 3.7250945 | 5343           | 3.7277852 | 5376           | 3.7304593 |
| 5311           | 3.7251763 | 5344           | 3.7278664 | 5377           | 3.7305400 |
| 5312           | 3.7252581 | 5345           | 3.7279477 | 5378           | 3.7306208 |
| 5313           | 3.7253398 | 5346           | 3.7280290 | 5379           | 3.7307015 |
| 5314           | 3.7254216 | 5347           | 3.7281102 | 5380           | 3.7307823 |
| 5315           | 3.7255033 | 5348           | 3.7281914 | 5381           | 3.7308630 |
| 5316           | 3.7255850 | 5349           | 3.7282726 | 5382           | 3.7309437 |
| 5317           | 3.7256667 | 5350           | 3.7283538 | 5383           | 3.7310244 |
| 5318           | 3.7257483 | 5351           | 3.7284350 | 5384           | 3.7311051 |
| 5319           | 3.7258300 | 5352           | 3.7285161 | 5385           | 3.7311857 |
| 5320           | 3.7259116 | 5353           | 3.7285972 | 5386           | 3.7312663 |
| 5321           | 3.7259933 | 5354           | 3.7286784 | 5387           | 3.7313470 |
| 5322           | 3.7260749 | 5355           | 3.7287595 | 5388           | 3.7314276 |
| 5323           | 3.7261565 | 5356           | 3.7288406 | 5389           | 3.7315082 |
| 5324           | 3.7262380 | 5357           | 3.7289216 | 5390           | 3.7315888 |
| 5325           | 3.7263196 | 5358           | 3.7290027 | 5391           | 3.7316693 |
| 5326           | 3.7264012 | 5359           | 3.7290838 | 5392           | 3.7317499 |
| 5327           | 3.7264827 | 5360           | 3.7291648 | 5393           | 3.7318304 |
| 5328           | 3.7265642 | 5361           | 3.7292458 | 5394           | 3.7319109 |
| 5329           | 3.7266457 | 5362           | 3.7293268 | 5395           | 3.7319914 |
| 5330           | 3.7267272 | 5363           | 3.7294078 | 5396           | 3.7320719 |
| 5331           | 3.7268087 | 5364           | 3.7294888 | 5397           | 3.7321524 |
| 5332           | 3.7268901 | 5365           | 3.7295697 | 5398           | 3.7322329 |
| 5333           | 3.7269716 | 5366           | 3.7296507 | 5399           | 3.7323133 |
| 5334           | 3.7270530 | 5367           | 3.7297316 | 5400           | 3.7323938 |

# 5400 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 5401           | 3.7324742 | 5434           | 3.7351196 | 5467           | 3.7377491 |
| 5402           | 3.7325546 | 5435           | 3.7351995 | 5468           | 3.7378285 |
| 5403           | 3.7326350 | 5436           | 3.7352794 | 5469           | 3.7379079 |
| 5404           | 3.7327153 | 5437           | 3.7353593 | 5470           | 3.7379873 |
| 5405           | 3.7327957 | 5438           | 3.7354392 | 5471           | 3.7380667 |
| 5406           | 3.7328760 | 5439           | 3.7355191 | 5472           | 3.7381461 |
| 5407           | 3.7329564 | 5440           | 3.7355989 | 5473           | 3.7382254 |
| 5408           | 3.7330367 | 5441           | 3.7356787 | 5474           | 3.7383048 |
| 5409           | 3.7331170 | 5442           | 3.7357585 | 5475           | 3.7383841 |
| 5410           | 3.7331973 | 5443           | 3.7358383 | 5476           | 3.7384634 |
| 5411           | 3.7332775 | 5444           | 3.7359181 | 5477           | 3.7385427 |
| 5412           | 3.7333578 | 5445           | 3.7359979 | 5478           | 3.7386220 |
| 5413           | 3.7334380 | 5446           | 3.7360776 | 5479           | 3.7387013 |
| 5414           | 3.7335183 | 5447           | 3.7361574 | 5480           | 3.7387806 |
| 5415           | 3.7335985 | 5448           | 3.7362371 | 5481           | 3.7388598 |
| 5416           | 3.7336787 | 5449           | 3.7363168 | 5482           | 3.7389390 |
| 5417           | 3.7337588 | 5450           | 3.7363965 | 5483           | 3.7390182 |
| 5418           | 3.7338390 | 5451           | 3.7364762 | 5484           | 3.7390974 |
| 5419           | 3.7339192 | 5452           | 3.7365558 | 5485           | 3.7391766 |
| 5420           | 3.7339993 | 5453           | 3.7366355 | 5486           | 3.7392558 |
| 5421           | 3.7340794 | 5454           | 3.7367151 | 5487           | 3.7393350 |
| 5422           | 3.7341595 | 5455           | 3.7367948 | 5488           | 3.7394141 |
| 5423           | 3.7342396 | 5456           | 3.7368744 | 5489           | 3.7394932 |
| 5424           | 3.7343197 | 5457           | 3.7369540 | 5490           | 3.7395723 |
| 5425           | 3.7343997 | 5458           | 3.7370335 | 5491           | 3.7396514 |
| 5426           | 3.7344798 | 5459           | 3.7371131 | 5492           | 3.7397305 |
| 5427           | 3.7345598 | 5460           | 3.7371926 | 5493           | 3.7398096 |
| 5428           | 3.7346398 | 5461           | 3.7372722 | 5494           | 3.7398887 |
| 5429           | 3.7347198 | 5462           | 3.7373517 | 5495           | 3.7399677 |
| 5430           | 3.7347998 | 5463           | 3.7374312 | 5496           | 3.7400467 |
| 5431           | 3.7348798 | 5464           | 3.7375107 | 5497           | 3.7401257 |
| 5432           | 3.7349598 | 5465           | 3.7375902 | 5498           | 3.7402047 |
| 5433           | 3.7350397 | 5466           | 3.7376696 | 5499           | 3.7402837 |
| 5434           | 3.7351196 | 5467           | 3.7377491 | 5500           | 3.7403627 |

# 5500 A TABLE of LOGARITHMS,

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 5501           | 3.7404416 | 5534           | 3.7430392 | 5567           | 3.7456212 |
| 5502           | 3.7405206 | 5535           | 3.7431176 | 5568           | 3.7456992 |
| 5503           | 3.7405995 | 5536           | 3.7431961 | 5569           | 3.7457772 |
| 5504           | 3.7406784 | 5537           | 3.7432745 | 5570           | 3.7458552 |
| 5505           | 3.7407573 | 5538           | 3.7433530 | 5571           | 3.7459332 |
| 5506           | 3.7408362 | 5539           | 3.7434314 | 5572           | 3.7460111 |
| 5507           | 3.7409151 | 5540           | 3.7435098 | 5573           | 3.7460890 |
| 5508           | 3.7409939 | 5541           | 3.7435881 | 5574           | 3.7461670 |
| 5509           | 3.7410728 | 5542           | 3.7436665 | 5575           | 3.7462449 |
| 5510           | 3.7411516 | 5543           | 3.7437449 | 5576           | 3.7463228 |
| 5511           | 3.7412304 | 5544           | 3.7438232 | 5577           | 3.7464006 |
| 5512           | 3.7413092 | 5545           | 3.7439016 | 5578           | 3.7464785 |
| 5513           | 3.7413880 | 5546           | 3.7439799 | 5579           | 3.7465564 |
| 5514           | 3.7414668 | 5547           | 3.7440582 | 5580           | 3.7466342 |
| 5515           | 3.7415455 | 5548           | 3.7441365 | 5581           | 3.7467120 |
| 5516           | 3.7416243 | 5549           | 3.7442147 | 5582           | 3.7467898 |
| 5517           | 3.7417030 | 5550           | 3.7442930 | 5583           | 3.7468676 |
| 5518           | 3.7417817 | 5551           | 3.7443712 | 5584           | 3.7469454 |
| 5519           | 3.7418604 | 5552           | 3.7444495 | 5585           | 3.7470232 |
| 5520           | 3.7419391 | 5553           | 3.7445277 | 5586           | 3.7471009 |
| 5521           | 3.7420177 | 5554           | 3.7446059 | 5587           | 3.7471787 |
| 5522           | 3.7420964 | 5555           | 3.7446841 | 5588           | 3.7472564 |
| 5523           | 3.7421750 | 5556           | 3.7447622 | 5589           | 3.7473341 |
| 5524           | 3.7422537 | 5557           | 3.7448404 | 5590           | 3.7474118 |
| 5525           | 3.7423323 | 5558           | 3.7449185 | 5591           | 3.7474895 |
| 5526           | 3.7424109 | 5559           | 3.7449967 | 5592           | 3.7475672 |
| 5527           | 3.7424895 | 5560           | 3.7450748 | 5593           | 3.7476448 |
| 5528           | 3.7425680 | 5561           | 3.7451529 | 5594           | 3.7477225 |
| 5529           | 3.7426466 | 5562           | 3.7452310 | 5595           | 3.7478001 |
| 5530           | 3.7427251 | 5563           | 3.7453091 | 5596           | 3.7478777 |
| 5531           | 3.7428037 | 5564           | 3.7453871 | 5597           | 3.7479553 |
| 5532           | 3.7428822 | 5565           | 3.7454652 | 5598           | 3.7480329 |
| 5533           | 3.7429607 | 5566           | 3.7455432 | 5599           | 3.7481105 |
| 5534           | 3.7430392 | 5567           | 3.7456212 | 600            | 3.7481880 |



# 5600 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 5601           | 3.7482656 | 5634           | 3.7508165 | 5667           | 3.7533532 |
| 5602           | 3.7483431 | 5635           | 3.7508939 | 5668           | 3.7534298 |
| 5603           | 3.7484206 | 5636           | 3.7509710 | 5669           | 3.7535065 |
| 5604           | 3.7484981 | 5637           | 3.7510480 | 5670           | 3.7535831 |
| 5605           | 3.7485756 | 5638           | 3.7511251 | 5671           | 3.7536596 |
| 5606           | 3.7486531 | 5639           | 3.7512021 | 5672           | 3.7537362 |
| 5607           | 3.7487306 | 5640           | 3.7512791 | 5673           | 3.7538128 |
| 5608           | 3.7488080 | 5641           | 3.7513561 | 5674           | 3.7538893 |
| 5609           | 3.7488854 | 5642           | 3.7514331 | 5675           | 3.7539659 |
| 5610           | 3.7489629 | 5643           | 3.7515101 | 5676           | 3.7540424 |
| 5611           | 3.7490403 | 5644           | 3.7515876 | 5677           | 3.7541189 |
| 5612           | 3.7491177 | 5645           | 3.7516639 | 5678           | 3.7541954 |
| 5613           | 3.7491950 | 5646           | 3.7517409 | 5679           | 3.7542719 |
| 5614           | 3.7492724 | 5647           | 3.7518178 | 5680           | 3.7543483 |
| 5615           | 3.7493498 | 5648           | 3.7518947 | 5681           | 3.7544248 |
| 5616           | 3.7494271 | 5649           | 3.7519716 | 5682           | 3.7545012 |
| 5617           | 3.7495044 | 5650           | 3.7520484 | 5683           | 3.7545777 |
| 5618           | 3.7495817 | 5651           | 3.7521253 | 5684           | 3.7546541 |
| 5619           | 3.7496590 | 5652           | 3.7522022 | 5685           | 3.7547305 |
| 5620           | 3.7497363 | 5653           | 3.7522791 | 5686           | 3.7548069 |
| 5621           | 3.7498136 | 5654           | 3.7523558 | 5687           | 3.7548832 |
| 5622           | 3.7498908 | 5655           | 3.7524326 | 5688           | 3.7549596 |
| 5623           | 3.7499681 | 5656           | 3.7525094 | 5689           | 3.7550359 |
| 5624           | 3.7500453 | 5657           | 3.7525862 | 5690           | 3.7551123 |
| 5625           | 3.7501225 | 5658           | 3.7526629 | 5691           | 3.7551886 |
| 5626           | 3.7501997 | 5659           | 3.7527397 | 5692           | 3.7552649 |
| 5627           | 3.7502769 | 5660           | 3.7528164 | 5693           | 3.7553412 |
| 5628           | 3.7503541 | 5661           | 3.7528932 | 5694           | 3.7554175 |
| 5629           | 3.7504312 | 5662           | 3.7529699 | 5695           | 3.7554937 |
| 5630           | 3.7505084 | 5663           | 3.7530466 | 5696           | 3.7555700 |
| 5631           | 3.7505855 | 5664           | 3.7531232 | 5697           | 3.7556462 |
| 5632           | 3.7506626 | 5665           | 3.7531999 | 5698           | 3.7557224 |
| 5633           | 3.7507398 | 5666           | 3.7532766 | 5699           | 3.7557987 |
| 5634           | 3.7508168 | 5667           | 3.7533532 | 5700           | 3.7558749 |

# 1700 A TABLE of LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 5761           | 3.7559510 | 5734           | 3.7584577 | 5767           | 3.7609500 |
| 5762           | 3.7560129 | 5735           | 3.7585334 | 5768           | 3.7610253 |
| 5763           | 3.7560894 | 5736           | 3.7586091 | 5769           | 3.7611005 |
| 5764           | 3.7561795 | 5737           | 3.7586848 | 5770           | 3.7611758 |
| 5765           | 3.7562550 | 5738           | 3.7587605 | 5771           | 3.7612511 |
| 5766           | 3.7563318 | 5739           | 3.7588362 | 5772           | 3.7613263 |
| 5767           | 3.7564079 | 5740           | 3.7589119 | 5773           | 3.7614016 |
| 5768           | 3.7564840 | 5741           | 3.7589875 | 5774           | 3.7614768 |
| 5769           | 3.7565600 | 5742           | 3.7590632 | 5775           | 3.7615520 |
| 5770           | 3.7566361 | 5743           | 3.7591388 | 5776           | 3.7616273 |
| 5771           | 3.7567122 | 5744           | 3.7592144 | 5777           | 3.7617024 |
| 5772           | 3.7567882 | 5745           | 3.7592900 | 5778           | 3.7617775 |
| 5773           | 3.7568642 | 5746           | 3.7593656 | 5779           | 3.7618527 |
| 5774           | 3.7569402 | 5747           | 3.7594412 | 5780           | 3.7619278 |
| 5775           | 3.7570162 | 5748           | 3.7595168 | 5781           | 3.7620030 |
| 5776           | 3.7570922 | 5749           | 3.7595923 | 5782           | 3.7620781 |
| 5777           | 3.7571682 | 5750           | 3.7596678 | 5783           | 3.7621532 |
| 5778           | 3.7572442 | 5751           | 3.7597434 | 5784           | 3.7622283 |
| 5779           | 3.7573201 | 5752           | 3.7598189 | 5785           | 3.7623034 |
| 5780           | 3.7573960 | 5753           | 3.7598944 | 5786           | 3.7623784 |
| 5781           | 3.7574719 | 5754           | 3.7599699 | 5787           | 3.7624535 |
| 5782           | 3.7575479 | 5755           | 3.7600453 | 5788           | 3.7625285 |
| 5783           | 3.7576237 | 5756           | 3.7601208 | 5789           | 3.7626035 |
| 5784           | 3.7576996 | 5757           | 3.7601962 | 5790           | 3.7626786 |
| 5785           | 3.7577755 | 5758           | 3.7602717 | 5791           | 3.7627536 |
| 5786           | 3.7578513 | 5759           | 3.7603471 | 5792           | 3.7628280 |
| 5787           | 3.7579272 | 5760           | 3.7604225 | 5793           | 3.7629035 |
| 5788           | 3.7580030 | 5761           | 3.7604979 | 5794           | 3.7629785 |
| 5789           | 3.7580788 | 5762           | 3.7605733 | 5795           | 3.7630534 |
| 5790           | 3.7581546 | 5763           | 3.7606486 | 5796           | 3.7631284 |
| 5791           | 3.7582304 | 5764           | 3.7607240 | 5797           | 3.7632033 |
| 5792           | 3.7583062 | 5765           | 3.7607993 | 5798           | 3.7632782 |
| 5793           | 3.7583819 | 5766           | 3.7608746 | 5799           | 3.7633531 |
| 5794           | 3.7584577 | 5767           | 3.7609500 | 5800           | 3.7634280 |

# 5800 A TABLE OF LOGARITHMS 0002

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 5801           | 3.7635029 | 5834           | 3.7659064 | 5867           | 3.7684161 |
| 5802           | 3.7635777 | 5835           | 3.7660409 | 5868           | 3.7684901 |
| 5803           | 3.7636526 | 5836           | 3.7661153 | 5869           | 3.7685641 |
| 5804           | 3.7637274 | 5837           | 3.7661897 | 5870           | 3.7686381 |
| 5805           | 3.7638022 | 5838           | 3.7662641 | 5871           | 3.7687121 |
| 5806           | 3.7638770 | 5839           | 3.7663385 | 5872           | 3.7687860 |
| 5807           | 3.7639518 | 5840           | 3.7664128 | 5873           | 3.7688600 |
| 5808           | 3.7640266 | 5841           | 3.7664872 | 5874           | 3.7689339 |
| 5809           | 3.7641014 | 5842           | 3.7665616 | 5875           | 3.7690079 |
| 5810           | 3.7641761 | 5843           | 3.7666359 | 5876           | 3.7690818 |
| 5811           | 3.7642509 | 5844           | 3.7667102 | 5877           | 3.7691557 |
| 5812           | 3.7643256 | 5845           | 3.7667845 | 5878           | 3.7692296 |
| 5813           | 3.7644003 | 5846           | 3.7668588 | 5879           | 3.7693035 |
| 5814           | 3.7644750 | 5847           | 3.7669331 | 5880           | 3.7693773 |
| 5815           | 3.7645497 | 5848           | 3.7670074 | 5881           | 3.7694512 |
| 5816           | 3.7646244 | 5849           | 3.7670816 | 5882           | 3.7695250 |
| 5817           | 3.7646991 | 5850           | 3.7671559 | 5883           | 3.7695988 |
| 5818           | 3.7647737 | 5851           | 3.7672301 | 5884           | 3.7696727 |
| 5819           | 3.7648484 | 5852           | 3.7673043 | 5885           | 3.7697465 |
| 5820           | 3.7649230 | 5853           | 3.7673785 | 5886           | 3.7698203 |
| 5821           | 3.7649976 | 5854           | 3.7674527 | 5887           | 3.7698940 |
| 5822           | 3.7650722 | 5855           | 3.7675269 | 5888           | 3.7699678 |
| 5823           | 3.7651468 | 5856           | 3.7676011 | 5889           | 3.7700415 |
| 5824           | 3.7652214 | 5857           | 3.7676752 | 5890           | 3.7701153 |
| 5825           | 3.7652959 | 5858           | 3.7677494 | 5891           | 3.7701890 |
| 5826           | 3.7653705 | 5859           | 3.7678235 | 5892           | 3.7702627 |
| 5827           | 3.7654450 | 5860           | 3.7678976 | 5893           | 3.7703364 |
| 5828           | 3.7655195 | 5861           | 3.7679717 | 5894           | 3.7704101 |
| 5829           | 3.7655941 | 5862           | 3.7680458 | 5895           | 3.7704838 |
| 5830           | 3.7656686 | 5863           | 3.7681199 | 5896           | 3.7705575 |
| 5831           | 3.7657430 | 5864           | 3.7681940 | 5897           | 3.7706311 |
| 5832           | 3.7658175 | 5865           | 3.7682680 | 5898           | 3.7707048 |
| 5833           | 3.7658920 | 5866           | 3.7683421 | 5899           | 3.7707784 |
| 5834           | 3.7659664 | 5867           | 3.7684161 | 5900           | 3.7708520 |



# 5900 A TABLE of LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 5901           | 3.7709256 | 5934           | 3.7733475 | 5967           | 3.7757560 |
| 5902           | 3.7709992 | 5935           | 3.7734207 | 5968           | 3.7758288 |
| 5903           | 3.7710728 | 5936           | 3.7734939 | 5969           | 3.7759016 |
| 5904           | 3.7711463 | 5937           | 3.7735670 | 5970           | 3.7759743 |
| 5905           | 3.7712199 | 5938           | 3.7736402 | 5971           | 3.7760471 |
| 5906           | 3.7712934 | 5939           | 3.7737133 | 5972           | 3.7761198 |
| 5907           | 3.7713670 | 5940           | 3.7737864 | 5973           | 3.7761925 |
| 5908           | 3.7714405 | 5941           | 3.7738595 | 5974           | 3.7762652 |
| 5909           | 3.7715140 | 5942           | 3.7739326 | 5975           | 3.7763379 |
| 5910           | 3.7715875 | 5943           | 3.7740057 | 5976           | 3.7764106 |
| 5911           | 3.7716610 | 5944           | 3.7740788 | 5977           | 3.7764833 |
| 5912           | 3.7717344 | 5945           | 3.7741519 | 5978           | 3.7765559 |
| 5913           | 3.7718079 | 5946           | 3.7742249 | 5979           | 3.7766285 |
| 5914           | 3.7718813 | 5947           | 3.7742979 | 5980           | 3.7767012 |
| 5915           | 3.7719547 | 5948           | 3.7743710 | 5981           | 3.7767738 |
| 5916           | 3.7720282 | 5949           | 3.7744440 | 5982           | 3.7768464 |
| 5917           | 3.7721016 | 5950           | 3.7745170 | 5983           | 3.7769190 |
| 5918           | 3.7721750 | 5951           | 3.7745899 | 5984           | 3.7769916 |
| 5919           | 3.7722483 | 5952           | 3.7746629 | 5985           | 3.7770641 |
| 5920           | 3.7723218 | 5953           | 3.7747359 | 5986           | 3.7771367 |
| 5921           | 3.7723951 | 5954           | 3.7748088 | 5987           | 3.7772093 |
| 5922           | 3.7724684 | 5955           | 3.7748818 | 5988           | 3.7772818 |
| 5923           | 3.7725417 | 5956           | 3.7749547 | 5989           | 3.7773543 |
| 5924           | 3.7726150 | 5957           | 3.7750276 | 5990           | 3.7774268 |
| 5925           | 3.7726883 | 5958           | 3.7751005 | 5991           | 3.7774993 |
| 5926           | 3.7727610 | 5959           | 3.7751734 | 5992           | 3.7775718 |
| 5927           | 3.7728349 | 5960           | 3.7752463 | 5993           | 3.7776443 |
| 5928           | 3.7729082 | 5961           | 3.7753191 | 5994           | 3.7777167 |
| 5929           | 3.7729814 | 5962           | 3.7753920 | 5995           | 3.7777892 |
| 5930           | 3.7730547 | 5963           | 3.7754648 | 5996           | 3.7778616 |
| 5931           | 3.7731279 | 5964           | 3.7755376 | 5997           | 3.7779340 |
| 5932           | 3.7732011 | 5965           | 3.7756104 | 5998           | 3.7780065 |
| 5933           | 3.7732743 | 5966           | 3.7756832 | 5999           | 3.7780789 |
| 5934           | 3.7733475 | 5967           | 3.7757560 | 6000           | 3.7781512 |

6000

# 6000 A TABLE of LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 6001           | 3.7782236 | 6034           | 3.7806053 | 6067           | 3.7829740 |
| 6002           | 3.7782960 | 6035           | 3.7806773 | 6068           | 3.7830456 |
| 6003           | 3.7783683 | 6036           | 3.7807492 | 6069           | 3.7831171 |
| 6004           | 3.7784407 | 6037           | 3.7808212 | 6070           | 3.7831887 |
| 6005           | 3.7785130 | 6038           | 3.7808931 | 6071           | 3.7832602 |
| 6006           | 3.7785853 | 6039           | 3.7809650 | 6072           | 3.7833318 |
| 6007           | 3.7786576 | 6040           | 3.7810369 | 6073           | 3.7834033 |
| 6008           | 3.7787299 | 6041           | 3.7811088 | 6074           | 3.7834748 |
| 6009           | 3.7788022 | 6042           | 3.7811807 | 6075           | 3.7835463 |
| 6010           | 3.7788745 | 6043           | 3.7812526 | 6076           | 3.7836178 |
| 6011           | 3.7789467 | 6044           | 3.7813245 | 6077           | 3.7836892 |
| 6012           | 3.7790190 | 6045           | 3.7813963 | 6078           | 3.7837607 |
| 6013           | 3.7790912 | 6046           | 3.7814681 | 6079           | 3.7838322 |
| 6014           | 3.7791634 | 6047           | 3.7815400 | 6080           | 3.7839036 |
| 6015           | 3.7792356 | 6048           | 3.7816118 | 6081           | 3.7839750 |
| 6016           | 3.7793078 | 6049           | 3.7816836 | 6082           | 3.7840464 |
| 6017           | 3.7793800 | 6050           | 3.7817554 | 6083           | 3.7841178 |
| 6018           | 3.7794522 | 6051           | 3.7818271 | 6084           | 3.7841892 |
| 6019           | 3.7795243 | 6052           | 3.7818989 | 6085           | 3.7842606 |
| 6020           | 3.7795965 | 6053           | 3.7819707 | 6086           | 3.7843319 |
| 6021           | 3.7796686 | 6054           | 3.7820424 | 6087           | 3.7844034 |
| 6022           | 3.7797407 | 6055           | 3.7821141 | 6088           | 3.7844746 |
| 6023           | 3.7798129 | 6056           | 3.7821859 | 6089           | 3.7845460 |
| 6024           | 3.7798850 | 6057           | 3.7822576 | 6090           | 3.7846173 |
| 6025           | 3.7799570 | 6058           | 3.7823293 | 6091           | 3.7846886 |
| 6026           | 3.7800291 | 6059           | 3.7824009 | 6092           | 3.7847599 |
| 6027           | 3.7801012 | 6060           | 3.7824726 | 6093           | 3.7848312 |
| 6028           | 3.7801732 | 6061           | 3.7825443 | 6094           | 3.7849024 |
| 6029           | 3.7802453 | 6062           | 3.7826159 | 6095           | 3.7849737 |
| 6030           | 3.7803173 | 6063           | 3.7826876 | 6096           | 3.7850450 |
| 6031           | 3.7803893 | 6064           | 3.7827592 | 6097           | 3.7851162 |
| 6032           | 3.7804613 | 6065           | 3.7828308 | 6098           | 3.7851874 |
| 6033           | 3.7805333 | 6066           | 3.7829024 | 6099           | 3.7852586 |
| 6034           | 3.7806053 | 6067           | 3.7829740 | 6100           | 3.7853298 |

# 6100 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 6101           | 3.7854010 | 6134           | 3.7877438 | 6167           | 3.7900739 |
| 6102           | 3.7854722 | 6135           | 3.7878146 | 6168           | 3.7901444 |
| 6103           | 3.7855434 | 6136           | 3.7878853 | 6169           | 3.7902148 |
| 6104           | 3.7856145 | 6137           | 3.7879561 | 6170           | 3.7902852 |
| 6105           | 3.7856857 | 6138           | 3.7880269 | 6171           | 3.7903555 |
| 6106           | 3.7857568 | 6139           | 3.7880976 | 6172           | 3.7904259 |
| 6107           | 3.7858279 | 6140           | 3.7881684 | 6173           | 3.7904963 |
| 6108           | 3.7858990 | 6141           | 3.7882391 | 6174           | 3.7905666 |
| 6109           | 3.7859701 | 6142           | 3.7883098 | 6175           | 3.7906370 |
| 6110           | 3.7860412 | 6143           | 3.7883805 | 6176           | 3.7907073 |
| 6111           | 3.7861123 | 6144           | 3.7884512 | 6177           | 3.7907776 |
| 6112           | 3.7861833 | 6145           | 3.7885219 | 6178           | 3.7908479 |
| 6113           | 3.7862544 | 6146           | 3.7885926 | 6179           | 3.7909182 |
| 6114           | 3.7863254 | 6147           | 3.7886632 | 6180           | 3.7909885 |
| 6115           | 3.7863965 | 6148           | 3.7887339 | 6181           | 3.7910587 |
| 6116           | 3.7864675 | 6149           | 3.7888045 | 6182           | 3.7911290 |
| 6117           | 3.7865384 | 6150           | 3.7888751 | 6183           | 3.7911992 |
| 6118           | 3.7866095 | 6151           | 3.7889457 | 6184           | 3.7912695 |
| 6119           | 3.7866804 | 6152           | 3.7890163 | 6185           | 3.7913397 |
| 6120           | 3.7867514 | 6153           | 3.7890869 | 6186           | 3.7914099 |
| 6121           | 3.7868224 | 6154           | 3.7891575 | 6187           | 3.7914801 |
| 6122           | 3.7868933 | 6155           | 3.7892281 | 6188           | 3.7915503 |
| 6123           | 3.7869643 | 6156           | 3.7892986 | 6189           | 3.7916205 |
| 6124           | 3.7870352 | 6157           | 3.7893691 | 6190           | 3.7916906 |
| 6125           | 3.7871061 | 6158           | 3.7894397 | 6191           | 3.7917608 |
| 6126           | 3.7871770 | 6159           | 3.7895102 | 6192           | 3.7918309 |
| 6127           | 3.7872479 | 6160           | 3.7895807 | 6193           | 3.7919011 |
| 6128           | 3.7873188 | 6161           | 3.7896512 | 6194           | 3.7919712 |
| 6129           | 3.7873896 | 6162           | 3.7897217 | 6195           | 3.7920413 |
| 6130           | 3.7874605 | 6163           | 3.7897922 | 6196           | 3.7921114 |
| 6131           | 3.7875313 | 6164           | 3.7898626 | 6197           | 3.7921815 |
| 6132           | 3.7876021 | 6165           | 3.7899331 | 6198           | 3.7922516 |
| 6133           | 3.7876730 | 6166           | 3.7900035 | 6199           | 3.7923216 |
| 6134           | 3.7877438 | 6167           | 3.7900739 | 6200           | 3.7923917 |



# 6200 A TABLE of LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 6201           | 3.7924617 | 6234           | 3.7947668 | 6267           | 3.7970597 |
| 6202           | 3.7925318 | 6235           | 3.7948365 | 6268           | 3.7971290 |
| 6203           | 3.7926018 | 6236           | 3.7949061 | 6269           | 3.7971983 |
| 6204           | 3.7926718 | 6237           | 3.7949757 | 6270           | 3.7972675 |
| 6205           | 3.7927418 | 6238           | 3.7950454 | 6271           | 3.7973368 |
| 6206           | 3.7928118 | 6239           | 3.7951150 | 6272           | 3.7974060 |
| 6207           | 3.7928817 | 6240           | 3.7951846 | 6273           | 3.7974753 |
| 6208           | 3.7929517 | 6241           | 3.7952542 | 6274           | 3.7975445 |
| 6209           | 3.7930217 | 6242           | 3.7953238 | 6275           | 3.7976137 |
| 6210           | 3.7930916 | 6243           | 3.7953933 | 6276           | 3.7976829 |
| 6211           | 3.7931615 | 6244           | 3.7954629 | 6277           | 3.7977521 |
| 6212           | 3.7932314 | 6245           | 3.7955324 | 6278           | 3.7978213 |
| 6213           | 3.7933013 | 6246           | 3.7956020 | 6279           | 3.7978905 |
| 6214           | 3.7933712 | 6247           | 3.7956715 | 6280           | 3.7979596 |
| 6215           | 3.7934411 | 6248           | 3.7957410 | 6281           | 3.7980288 |
| 6216           | 3.7935110 | 6249           | 3.7958105 | 6282           | 3.7980979 |
| 6217           | 3.7935809 | 6250           | 3.7958800 | 6283           | 3.7981671 |
| 6218           | 3.7936507 | 6251           | 3.7959495 | 6284           | 3.7982362 |
| 6219           | 3.7937206 | 6252           | 3.7960190 | 6285           | 3.7983053 |
| 6220           | 3.7937904 | 6253           | 3.7960884 | 6286           | 3.7983744 |
| 6221           | 3.7938602 | 6254           | 3.7961579 | 6287           | 3.7984434 |
| 6222           | 3.7939300 | 6255           | 3.7962273 | 6288           | 3.7985125 |
| 6223           | 3.7939998 | 6256           | 3.7962967 | 6289           | 3.7985816 |
| 6224           | 3.7940696 | 6257           | 3.7963662 | 6290           | 3.7986506 |
| 6225           | 3.7941394 | 6258           | 3.7964356 | 6291           | 3.7987197 |
| 6226           | 3.7942091 | 6259           | 3.7965049 | 6292           | 3.7987887 |
| 6227           | 3.7942789 | 6260           | 3.7965743 | 6293           | 3.7988577 |
| 6228           | 3.7943486 | 6261           | 3.7966437 | 6294           | 3.7989267 |
| 6229           | 3.7944183 | 6262           | 3.7967131 | 6295           | 3.7989957 |
| 6230           | 3.7944880 | 6263           | 3.7967824 | 6296           | 3.7990647 |
| 6231           | 3.7945577 | 6264           | 3.7968517 | 6297           | 3.7991337 |
| 6232           | 3.7946274 | 6265           | 3.7969211 | 6298           | 3.7992027 |
| 6233           | 3.7946971 | 6266           | 3.7969904 | 6299           | 3.7992716 |
| 6234           | 3.7947668 | 6267           | 3.7970597 | 6300           | 3.7993405 |

# 6300 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 6301           | 3.7994095 | 6334           | 3.8016781 | 6367           | 3.8039348 |
| 6302           | 3.7994784 | 6335           | 3.8017466 | 6368           | 3.8040030 |
| 6303           | 3.7995473 | 6336           | 3.8018152 | 6369           | 3.8040712 |
| 6304           | 3.7996162 | 6337           | 3.8018837 | 6370           | 3.8041394 |
| 6305           | 3.7996851 | 6338           | 3.8019522 | 6371           | 3.8042076 |
| 6306           | 3.7997540 | 6339           | 3.8020208 | 6372           | 3.8042758 |
| 6307           | 3.7998228 | 6340           | 3.8020893 | 6373           | 3.8043439 |
| 6308           | 3.7998917 | 6341           | 3.8021578 | 6374           | 3.8044121 |
| 6309           | 3.7999605 | 6342           | 3.8022262 | 6375           | 3.8044802 |
| 6310           | 3.8000294 | 6343           | 3.8022947 | 6376           | 3.8045483 |
| 6311           | 3.8000982 | 6344           | 3.8023632 | 6377           | 3.8046164 |
| 6312           | 3.8001670 | 6345           | 3.8024316 | 6378           | 3.8046845 |
| 6313           | 3.8002358 | 6346           | 3.8025001 | 6379           | 3.8047526 |
| 6314           | 3.8003046 | 6347           | 3.8025685 | 6380           | 3.8048207 |
| 6315           | 3.8003734 | 6348           | 3.8026369 | 6381           | 3.8048887 |
| 6316           | 3.8004421 | 6349           | 3.8027053 | 6382           | 3.8049568 |
| 6317           | 3.8005109 | 6350           | 3.8027737 | 6383           | 3.8050248 |
| 6318           | 3.8005796 | 6351           | 3.8028421 | 6384           | 3.8050929 |
| 6319           | 3.8006484 | 6352           | 3.8029105 | 6385           | 3.8051609 |
| 6320           | 3.8007171 | 6353           | 3.8029789 | 6386           | 3.8052289 |
| 6321           | 3.8007858 | 6354           | 3.8030472 | 6387           | 3.8052969 |
| 6322           | 3.8008545 | 6355           | 3.8031155 | 6388           | 3.8053649 |
| 6323           | 3.8009232 | 6356           | 3.8031839 | 6389           | 3.8054329 |
| 6324           | 3.8009919 | 6357           | 3.8032522 | 6390           | 3.8055009 |
| 6325           | 3.8010605 | 6358           | 3.8033205 | 6391           | 3.8055688 |
| 6326           | 3.8011292 | 6359           | 3.8033888 | 6392           | 3.8056368 |
| 6327           | 3.8011978 | 6360           | 3.8034571 | 6393           | 3.8057047 |
| 6328           | 3.8012665 | 6361           | 3.8035254 | 6394           | 3.8057726 |
| 6329           | 3.8013351 | 6362           | 3.8035937 | 6395           | 3.8058405 |
| 6330           | 3.8014037 | 6363           | 3.8036619 | 6396           | 3.8059085 |
| 6331           | 3.8014723 | 6364           | 3.8037302 | 6397           | 3.8059763 |
| 6332           | 3.8015409 | 6365           | 3.8037984 | 6398           | 3.8060442 |
| 6333           | 3.8016095 | 6366           | 3.8038666 | 6399           | 3.8061121 |
| 6334           | 3.8016781 | 6367           | 3.8039348 | 6400           | 3.8061800 |

# 6400 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 6401           | 3.8062478 | 6434           | 3.8084811 | 6467           | 3.8107029 |
| 6402           | 3.8063157 | 6435           | 3.8085485 | 6468           | 3.8107700 |
| 6403           | 3.8063835 | 6436           | 3.8086160 | 6469           | 3.8108371 |
| 6404           | 3.8064513 | 6437           | 3.8086835 | 6470           | 3.8109043 |
| 6405           | 3.8065191 | 6438           | 3.8087510 | 6471           | 3.8109714 |
| 6406           | 3.8065869 | 6439           | 3.8088184 | 6472           | 3.8110385 |
| 6407           | 3.8066547 | 6440           | 3.8088859 | 6473           | 3.8111056 |
| 6408           | 3.8067225 | 6441           | 3.8089533 | 6474           | 3.8111727 |
| 6409           | 3.8067903 | 6442           | 3.8090207 | 6475           | 3.8112398 |
| 6410           | 3.8068580 | 6443           | 3.8090881 | 6476           | 3.8113068 |
| 6411           | 3.8069258 | 6444           | 3.8091555 | 6477           | 3.8113739 |
| 6412           | 3.8069935 | 6445           | 3.8092229 | 6478           | 3.8114409 |
| 6413           | 3.8070613 | 6446           | 3.8092903 | 6479           | 3.8115080 |
| 6414           | 3.8071290 | 6447           | 3.8093577 | 6480           | 3.8115750 |
| 6415           | 3.8071967 | 6448           | 3.8094250 | 6481           | 3.8116420 |
| 6416           | 3.8072644 | 6449           | 3.8094924 | 6482           | 3.8117090 |
| 6417           | 3.8073320 | 6450           | 3.8095597 | 6483           | 3.8117760 |
| 6418           | 3.8073997 | 6451           | 3.8096270 | 6484           | 3.8118430 |
| 6419           | 3.8074674 | 6452           | 3.8096944 | 6485           | 3.8119100 |
| 6420           | 3.8075350 | 6453           | 3.8097617 | 6486           | 3.8119769 |
| 6421           | 3.8076027 | 6454           | 3.8098290 | 6487           | 3.8120439 |
| 6422           | 3.8076703 | 6455           | 3.8098962 | 6488           | 3.8121108 |
| 6423           | 3.8077379 | 6456           | 3.8099635 | 6489           | 3.8121778 |
| 6424           | 3.8078055 | 6457           | 3.8100308 | 6490           | 3.8122447 |
| 6425           | 3.8078731 | 6458           | 3.8100980 | 6491           | 3.8123116 |
| 6426           | 3.8079407 | 6459           | 3.8101653 | 6492           | 3.8123785 |
| 6427           | 3.8080083 | 6460           | 3.8102325 | 6493           | 3.8124454 |
| 6428           | 3.8080759 | 6461           | 3.8102997 | 6494           | 3.8125123 |
| 6429           | 3.8081434 | 6462           | 3.8103669 | 6495           | 3.8125792 |
| 6430           | 3.8082110 | 6463           | 3.8104342 | 6496           | 3.8126460 |
| 6431           | 3.8082785 | 6464           | 3.8105013 | 6497           | 3.8127129 |
| 6432           | 3.8083460 | 6465           | 3.8105685 | 6498           | 3.8127797 |
| 6433           | 3.8084135 | 6466           | 3.8106357 | 6499           | 3.8128465 |
| 6434           | 3.8084811 | 6467           | 3.8107029 | 6500           | 3.8129134 |

6500



# 6500 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 6501           | 3.8129802 | 6534           | 3.8151791 | 6567           | 3.8173670 |
| 6502           | 3.8130470 | 6535           | 3.8152456 | 6568           | 3.8174331 |
| 6503           | 3.8131137 | 6536           | 3.8153120 | 6569           | 3.8174993 |
| 6504           | 3.8131805 | 6537           | 3.8153785 | 6570           | 3.8175654 |
| 6505           | 3.8132473 | 6538           | 3.8154449 | 6571           | 3.8176315 |
| 6506           | 3.8133141 | 6539           | 3.8155113 | 6572           | 3.8176975 |
| 6507           | 3.8133808 | 6540           | 3.8155777 | 6573           | 3.8177636 |
| 6508           | 3.8134475 | 6541           | 3.8156441 | 6574           | 3.8178297 |
| 6509           | 3.8135143 | 6542           | 3.8157105 | 6575           | 3.8178958 |
| 6510           | 3.8135810 | 6543           | 3.8157769 | 6576           | 3.8179618 |
| 6511           | 3.8136477 | 6544           | 3.8158433 | 6577           | 3.8180278 |
| 6512           | 3.8137144 | 6545           | 3.8159096 | 6578           | 3.8180939 |
| 6513           | 3.8137811 | 6546           | 3.8159760 | 6579           | 3.8181599 |
| 6514           | 3.8138477 | 6547           | 3.8160423 | 6580           | 3.8182259 |
| 6515           | 3.8139144 | 6548           | 3.8161087 | 6581           | 3.8182919 |
| 6516           | 3.8139811 | 6549           | 3.8161750 | 6582           | 3.8183579 |
| 6517           | 3.8140478 | 6550           | 3.8162413 | 6583           | 3.8184239 |
| 6518           | 3.8141144 | 6551           | 3.8163076 | 6584           | 3.8184898 |
| 6519           | 3.8141810 | 6552           | 3.8163739 | 6585           | 3.8185558 |
| 6520           | 3.8142476 | 6553           | 3.8164402 | 6586           | 3.8186217 |
| 6521           | 3.8143142 | 6554           | 3.8165064 | 6587           | 3.8186877 |
| 6522           | 3.8143808 | 6555           | 3.8165727 | 6588           | 3.8187536 |
| 6523           | 3.8144474 | 6556           | 3.8166389 | 6589           | 3.8188195 |
| 6524           | 3.8145139 | 6557           | 3.8167052 | 6590           | 3.8188854 |
| 6525           | 3.8145805 | 6558           | 3.8167714 | 6591           | 3.8189513 |
| 6526           | 3.8146471 | 6559           | 3.8168376 | 6592           | 3.8190172 |
| 6527           | 3.8147136 | 6560           | 3.8169038 | 6593           | 3.8190831 |
| 6528           | 3.8147801 | 6561           | 3.8169700 | 6594           | 3.8191489 |
| 6529           | 3.8148467 | 6562           | 3.8170362 | 6595           | 3.8192148 |
| 6530           | 3.8149132 | 6563           | 3.8171024 | 6596           | 3.8192806 |
| 6531           | 3.8149797 | 6564           | 3.8171686 | 6597           | 3.8193465 |
| 6532           | 3.8150462 | 6565           | 3.8172347 | 6598           | 3.8194123 |
| 6533           | 3.8151127 | 6566           | 3.8173009 | 6599           | 3.8194781 |
| 6534           | 3.8151791 | 6567           | 3.8173670 | 6600           | 3.8195439 |

# 6600 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 6601           | 3.8196097 | 6634           | 3.8217755 | 6667           | 3.8239305 |
| 6602           | 3.8196755 | 6635           | 3.8218409 | 6668           | 3.8239956 |
| 6603           | 3.8197413 | 6636           | 3.8219064 | 6669           | 3.8240607 |
| 6604           | 3.8198071 | 6637           | 3.8219718 | 6670           | 3.8241258 |
| 6605           | 3.8198728 | 6638           | 3.8220372 | 6671           | 3.8241909 |
| 6606           | 3.8199386 | 6639           | 3.8221027 | 6672           | 3.8242560 |
| 6607           | 3.8200043 | 6640           | 3.8221681 | 6673           | 3.8243211 |
| 6608           | 3.8200700 | 6641           | 3.8222335 | 6674           | 3.8243862 |
| 6609           | 3.8201357 | 6642           | 3.8222989 | 6675           | 3.8244513 |
| 6610           | 3.8202015 | 6643           | 3.8223642 | 6676           | 3.8245163 |
| 6611           | 3.8202672 | 6644           | 3.8224296 | 6677           | 3.8245814 |
| 6612           | 3.8203328 | 6645           | 3.8224950 | 6678           | 3.8246464 |
| 6613           | 3.8203985 | 6646           | 3.8225603 | 6679           | 3.8247114 |
| 6614           | 3.8204642 | 6647           | 3.8226257 | 6680           | 3.8247765 |
| 6615           | 3.8205298 | 6648           | 3.8226910 | 6681           | 3.8248415 |
| 6616           | 3.8205955 | 6649           | 3.8227563 | 6682           | 3.8249065 |
| 6617           | 3.8206611 | 6650           | 3.8228216 | 6683           | 3.8249715 |
| 6618           | 3.8207268 | 6651           | 3.8228869 | 6684           | 3.8250364 |
| 6619           | 3.8207924 | 6652           | 3.8229522 | 6685           | 3.8251014 |
| 6620           | 3.8208580 | 6653           | 3.8230175 | 6686           | 3.8251664 |
| 6621           | 3.8209236 | 6654           | 3.8230828 | 6687           | 3.8252313 |
| 6622           | 3.8209892 | 6655           | 3.8231481 | 6688           | 3.8252963 |
| 6623           | 3.8210548 | 6656           | 3.8232133 | 6689           | 3.8253612 |
| 6624           | 3.8211203 | 6657           | 3.8232786 | 6690           | 3.8254261 |
| 6625           | 3.8211859 | 6658           | 3.8233438 | 6691           | 3.8254910 |
| 6626           | 3.8212514 | 6659           | 3.8234090 | 6692           | 3.8255559 |
| 6627           | 3.8213170 | 6660           | 3.8234742 | 6693           | 3.8256208 |
| 6628           | 3.8213825 | 6661           | 3.8235394 | 6694           | 3.8256857 |
| 6629           | 3.8214480 | 6662           | 3.8236046 | 6695           | 3.8257506 |
| 6630           | 3.8215135 | 6663           | 3.8236698 | 6696           | 3.8258154 |
| 6631           | 3.8215790 | 6664           | 3.8237350 | 6697           | 3.8258803 |
| 6632           | 3.8216445 | 6665           | 3.8238002 | 6698           | 3.8259451 |
| 6633           | 3.8217100 | 6666           | 3.8238653 | 6699           | 3.8260100 |
| 6634           | 3.8217755 | 6667           | 3.8239305 | 6700           | 3.8260748 |

# 6700 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 6701           | 3.8261396 | 6734           | 3.8282731 | 6767           | 3.8303962 |
| 6702           | 3.8262044 | 6735           | 3.8283376 | 6768           | 3.8304604 |
| 6703           | 3.8262692 | 6736           | 3.8284021 | 6769           | 3.8305245 |
| 6704           | 3.8263340 | 6737           | 3.8284665 | 6770           | 3.8305887 |
| 6705           | 3.8263988 | 6738           | 3.8285310 | 6771           | 3.8306528 |
| 6706           | 3.8264635 | 6739           | 3.8285955 | 6772           | 3.8307169 |
| 6707           | 3.8265283 | 6740           | 3.8286599 | 6773           | 3.8307811 |
| 6708           | 3.8265931 | 6741           | 3.8287243 | 6774           | 3.8308452 |
| 6709           | 3.8266578 | 6742           | 3.8287887 | 6775           | 3.8309093 |
| 6710           | 3.8267225 | 6743           | 3.8288532 | 6776           | 3.8309734 |
| 6711           | 3.8267872 | 6744           | 3.8289176 | 6777           | 3.8310375 |
| 6712           | 3.8268519 | 6745           | 3.8289820 | 6778           | 3.8311016 |
| 6713           | 3.8269166 | 6746           | 3.8290463 | 6779           | 3.8311656 |
| 6714           | 3.8269813 | 6747           | 3.8291107 | 6780           | 3.8312297 |
| 6715           | 3.8270460 | 6748           | 3.8291751 | 6781           | 3.8312937 |
| 6716           | 3.8271107 | 6749           | 3.8292394 | 6782           | 3.8313578 |
| 6717           | 3.8271753 | 6750           | 3.8293038 | 6783           | 3.8314218 |
| 6718           | 3.8272400 | 6751           | 3.8293681 | 6784           | 3.8314858 |
| 6719           | 3.8273046 | 6752           | 3.8294324 | 6785           | 3.8315499 |
| 6720           | 3.8273693 | 6753           | 3.8294967 | 6786           | 3.8316139 |
| 6721           | 3.8274339 | 6754           | 3.8295611 | 6787           | 3.8316778 |
| 6722           | 3.8274985 | 6755           | 3.8296254 | 6788           | 3.8317418 |
| 6723           | 3.8275631 | 6756           | 3.8296896 | 6789           | 3.8318058 |
| 6724           | 3.8276277 | 6757           | 3.8297539 | 6790           | 3.8318698 |
| 6725           | 3.8276923 | 6758           | 3.8298182 | 6791           | 3.8319337 |
| 6726           | 3.8277569 | 6759           | 3.8298824 | 6792           | 3.8319977 |
| 6727           | 3.8278214 | 6760           | 3.8299467 | 6793           | 3.8320616 |
| 6728           | 3.8278860 | 6761           | 3.8300109 | 6794           | 3.8321255 |
| 6729           | 3.8279505 | 6762           | 3.8300752 | 6795           | 3.8321895 |
| 6730           | 3.8280151 | 6763           | 3.8301394 | 6796           | 3.8322534 |
| 6731           | 3.8280796 | 6764           | 3.8302036 | 6797           | 3.8323173 |
| 6732           | 3.8281441 | 6765           | 3.8302678 | 6798           | 3.8323812 |
| 6733           | 3.8282086 | 6766           | 3.8303320 | 6799           | 3.8324450 |
| 6734           | 3.8282731 | 6767           | 3.8303962 | 6800           | 3.8325089 |



6800 A TABLE OF LOGARITHMS. 0000

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 6801           | 3.8325728 | 6834           | 3.8346750 | 6867           | 3.8367670 |
| 6802           | 3.8326366 | 6835           | 3.8347385 | 6868           | 3.8368303 |
| 6803           | 3.8327005 | 6836           | 3.8348021 | 6869           | 3.8368935 |
| 6804           | 3.8327643 | 6837           | 3.8348656 | 6870           | 3.8369567 |
| 6805           | 3.8328281 | 6838           | 3.8349291 | 6871           | 3.8370199 |
| 6806           | 3.8328919 | 6839           | 3.8349926 | 6872           | 3.8370832 |
| 6807           | 3.8329558 | 6840           | 3.8350561 | 6873           | 3.8371463 |
| 6808           | 3.8330195 | 6841           | 3.8351196 | 6874           | 3.8372095 |
| 6809           | 3.8330833 | 6842           | 3.8351831 | 6875           | 3.8372727 |
| 6810           | 3.8331471 | 6843           | 3.8352465 | 6876           | 3.8373359 |
| 6811           | 3.8332109 | 6844           | 3.8353100 | 6877           | 3.8373990 |
| 6812           | 3.8332746 | 6845           | 3.8353735 | 6878           | 3.8374622 |
| 6813           | 3.8333384 | 6846           | 3.8354369 | 6879           | 3.8375253 |
| 6814           | 3.8334021 | 6847           | 3.8355003 | 6880           | 3.8375884 |
| 6815           | 3.8334659 | 6848           | 3.8355638 | 6881           | 3.8376516 |
| 6816           | 3.8335296 | 6849           | 3.8356272 | 6882           | 3.8377147 |
| 6817           | 3.8335933 | 6850           | 3.8356906 | 6883           | 3.8377778 |
| 6818           | 3.8336570 | 6851           | 3.8357540 | 6884           | 3.8378409 |
| 6819           | 3.8337207 | 6852           | 3.8358174 | 6885           | 3.8379039 |
| 6820           | 3.8337844 | 6853           | 3.8358807 | 6886           | 3.8379670 |
| 6821           | 3.8338480 | 6854           | 3.8359441 | 6887           | 3.8380301 |
| 6822           | 3.8339117 | 6855           | 3.8360075 | 6888           | 3.8380931 |
| 6823           | 3.8339754 | 6856           | 3.8360708 | 6889           | 3.8381562 |
| 6824           | 3.8340390 | 6857           | 3.8361341 | 6890           | 3.8382192 |
| 6825           | 3.8341027 | 6858           | 3.8361975 | 6891           | 3.8382822 |
| 6826           | 3.8341663 | 6859           | 3.8362608 | 6892           | 3.8383453 |
| 6827           | 3.8342299 | 6860           | 3.8363241 | 6893           | 3.8384083 |
| 6828           | 3.8342935 | 6861           | 3.8363874 | 6894           | 3.8384713 |
| 6829           | 3.8343571 | 6862           | 3.8364507 | 6895           | 3.8385343 |
| 6830           | 3.8344207 | 6863           | 3.8365140 | 6896           | 3.8385973 |
| 6831           | 3.8344843 | 6864           | 3.8365773 | 6897           | 3.8386602 |
| 6832           | 3.8345479 | 6865           | 3.8366405 | 6898           | 3.8387232 |
| 6833           | 3.8346114 | 6866           | 3.8367038 | 6899           | 3.8387861 |
| 6834           | 3.8346750 | 6867           | 3.8367670 | 6900           | 3.8388491 |

# 6900 A TABLE OF LOGARITHMS. 0080

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 6901           | 3.8389120 | 6934           | 3.8409838 | 6967           | 3.8430458 |
| 6902           | 3.8389750 | 6935           | 3.8410465 | 6968           | 3.8431081 |
| 6903           | 3.8390379 | 6936           | 3.8411091 | 6969           | 3.8431705 |
| 6904           | 3.8391008 | 6937           | 3.8411717 | 6970           | 3.8432328 |
| 6905           | 3.8391637 | 6938           | 3.8412343 | 6971           | 3.8432951 |
| 6906           | 3.8392266 | 6939           | 3.8412969 | 6972           | 3.8433574 |
| 6907           | 3.8392895 | 6940           | 3.8413595 | 6973           | 3.8434197 |
| 6908           | 3.8393523 | 6941           | 3.8414220 | 6974           | 3.8434819 |
| 6909           | 3.8394152 | 6942           | 3.8414846 | 6975           | 3.8435442 |
| 6910           | 3.8394780 | 6943           | 3.8415472 | 6976           | 3.8436065 |
| 6911           | 3.8395409 | 6944           | 3.8416097 | 6977           | 3.8436687 |
| 6912           | 3.8396037 | 6945           | 3.8416723 | 6978           | 3.8437310 |
| 6913           | 3.8396666 | 6946           | 3.8417348 | 6979           | 3.8437932 |
| 6914           | 3.8397294 | 6947           | 3.8417973 | 6980           | 3.8438554 |
| 6915           | 3.8397922 | 6948           | 3.8418598 | 6981           | 3.8439176 |
| 6916           | 3.8398550 | 6949           | 3.8419224 | 6982           | 3.8439798 |
| 6917           | 3.8399178 | 6950           | 3.8419848 | 6983           | 3.8440420 |
| 6918           | 3.8399806 | 6951           | 3.8420473 | 6984           | 3.8441042 |
| 6919           | 3.8400433 | 6952           | 3.8421098 | 6985           | 3.8441664 |
| 6920           | 3.8401061 | 6953           | 3.8421722 | 6986           | 3.8442286 |
| 6921           | 3.8401688 | 6954           | 3.8422347 | 6987           | 3.8442907 |
| 6922           | 3.8402316 | 6955           | 3.8422971 | 6988           | 3.8443529 |
| 6923           | 3.8402943 | 6956           | 3.8423596 | 6989           | 3.8444150 |
| 6924           | 3.8403571 | 6957           | 3.8424220 | 6990           | 3.8444772 |
| 6925           | 3.8404198 | 6958           | 3.8424844 | 6991           | 3.8445393 |
| 6926           | 3.8404825 | 6959           | 3.8425468 | 6992           | 3.8446014 |
| 6927           | 3.8405452 | 6960           | 3.8426092 | 6993           | 3.8446635 |
| 6928           | 3.8406079 | 6961           | 3.8426716 | 6994           | 3.8447256 |
| 6929           | 3.8406706 | 6962           | 3.8427340 | 6995           | 3.8447877 |
| 6930           | 3.8407332 | 6963           | 3.8427964 | 6996           | 3.8448498 |
| 6931           | 3.8407959 | 6964           | 3.8428588 | 6997           | 3.8449119 |
| 6932           | 3.8408586 | 6965           | 3.8429211 | 6998           | 3.8449739 |
| 6933           | 3.8409212 | 6966           | 3.8429835 | 6999           | 3.8450360 |
| 6934           | 3.8409838 | 6967           | 3.8430458 | 7000           | 3.8450980 |

# 7000. 2 A TABLE OF LOGARITHMS. 0015

| N <sup>o</sup> | Logarithm | N <sup>o</sup> | Logarithm | N <sup>o</sup> | Logarithm  |
|----------------|-----------|----------------|-----------|----------------|------------|
| 7001           | 3.8451001 | 7034           | 3.8472024 | 7067           | 3.8493351  |
| 7002           | 3.8452221 | 7035           | 3.8472641 | 7068           | 3.8493965  |
| 7003           | 3.8453441 | 7036           | 3.8473258 | 7069           | 3.8494580  |
| 7004           | 3.8454661 | 7037           | 3.8473876 | 7070           | 3.8495194  |
| 7005           | 3.8455881 | 7038           | 3.8474493 | 7071           | 3.8495808  |
| 7006           | 3.8457101 | 7039           | 3.8475110 | 7072           | 3.8496423  |
| 7007           | 3.8458321 | 7040           | 3.8475727 | 7073           | 3.8497037  |
| 7008           | 3.8459541 | 7041           | 3.8476343 | 7074           | 3.8497651  |
| 7009           | 3.8460761 | 7042           | 3.8476960 | 7075           | 3.8498264  |
| 7010           | 3.8461980 | 7043           | 3.8477577 | 7076           | 3.8498878  |
| 7011           | 3.8463200 | 7044           | 3.8478193 | 7077           | 3.8499492  |
| 7012           | 3.8464419 | 7045           | 3.8478810 | 7078           | 3.84999106 |
| 7013           | 3.8465638 | 7046           | 3.8479426 | 7079           | 3.8500524  |
| 7014           | 3.8466858 | 7047           | 3.8480043 | 7080           | 3.8501138  |
| 7015           | 3.8468077 | 7048           | 3.8480659 | 7081           | 3.8501752  |
| 7016           | 3.8469296 | 7049           | 3.8481275 | 7082           | 3.8502366  |
| 7017           | 3.8470515 | 7050           | 3.8481891 | 7083           | 3.8502980  |
| 7018           | 3.8471734 | 7051           | 3.8482507 | 7084           | 3.8503594  |
| 7019           | 3.8472952 | 7052           | 3.8483123 | 7085           | 3.8504208  |
| 7020           | 3.8474171 | 7053           | 3.8483739 | 7086           | 3.8504822  |
| 7021           | 3.8475390 | 7054           | 3.8484355 | 7087           | 3.8505436  |
| 7022           | 3.8476608 | 7055           | 3.8484970 | 7088           | 3.8506050  |
| 7023           | 3.8477827 | 7056           | 3.8485586 | 7089           | 3.8506664  |
| 7024           | 3.8479045 | 7057           | 3.8486201 | 7090           | 3.8507278  |
| 7025           | 3.8480263 | 7058           | 3.8486817 | 7091           | 3.8507892  |
| 7026           | 3.8481481 | 7059           | 3.8487432 | 7092           | 3.8508506  |
| 7027           | 3.8482700 | 7060           | 3.8488047 | 7093           | 3.8509120  |
| 7028           | 3.8483918 | 7061           | 3.8488662 | 7094           | 3.8509734  |
| 7029           | 3.8485135 | 7062           | 3.8489277 | 7095           | 3.8510348  |
| 7030           | 3.8486353 | 7063           | 3.8489892 | 7096           | 3.8510962  |
| 7031           | 3.8487571 | 7064           | 3.8490507 | 7097           | 3.8511576  |
| 7032           | 3.8488789 | 7065           | 3.8491122 | 7098           | 3.8512190  |
| 7033           | 3.8489996 | 7066           | 3.8491736 | 7099           | 3.8512804  |
| 7034           | 3.8491214 | 7067           | 3.8492351 | 7100           | 3.8513418  |



# 7100 . A TABLE OF LOGARITHMS. 0007

| Nº   | Logarith. | Nº   | Logarith. | Nº   | Logarith. |
|------|-----------|------|-----------|------|-----------|
| 7101 | 3.8513195 | 7134 | 3.8533331 | 7167 | 3.8553374 |
| 7102 | 3.8513807 | 7135 | 3.8533940 | 7168 | 3.8553980 |
| 7103 | 3.8514418 | 7136 | 3.8534548 | 7169 | 3.8554586 |
| 7104 | 3.8515030 | 7137 | 3.8535157 | 7170 | 3.8555192 |
| 7105 | 3.8515641 | 7138 | 3.8535765 | 7171 | 3.8555797 |
| 7106 | 3.8516252 | 7139 | 3.8536374 | 7172 | 3.8556403 |
| 7107 | 3.8516863 | 7140 | 3.8536982 | 7173 | 3.8557008 |
| 7108 | 3.8517474 | 7141 | 3.8537590 | 7174 | 3.8557614 |
| 7109 | 3.8518085 | 7142 | 3.8538198 | 7175 | 3.8558219 |
| 7110 | 3.8518696 | 7143 | 3.8538807 | 7176 | 3.8558824 |
| 7111 | 3.8519307 | 7144 | 3.8539414 | 7177 | 3.8559429 |
| 7112 | 3.8519917 | 7145 | 3.8540022 | 7178 | 3.8560035 |
| 7113 | 3.8520528 | 7146 | 3.8540630 | 7179 | 3.8560640 |
| 7114 | 3.8521139 | 7147 | 3.8541238 | 7180 | 3.8561244 |
| 7115 | 3.8521749 | 7148 | 3.8541845 | 7181 | 3.8561849 |
| 7116 | 3.8522359 | 7149 | 3.8542453 | 7182 | 3.8562454 |
| 7117 | 3.8522970 | 7150 | 3.8543060 | 7183 | 3.8563059 |
| 7118 | 3.8523580 | 7151 | 3.8543668 | 7184 | 3.8563663 |
| 7119 | 3.8524190 | 7152 | 3.8544275 | 7185 | 3.8564268 |
| 7120 | 3.8524800 | 7153 | 3.8544882 | 7186 | 3.8564872 |
| 7121 | 3.8525410 | 7154 | 3.8545489 | 7187 | 3.8565476 |
| 7122 | 3.8526020 | 7155 | 3.854609  | 7188 | 3.8566081 |
| 7123 | 3.8526629 | 7156 | 3.8546703 | 7189 | 3.8566685 |
| 7124 | 3.8527239 | 7157 | 3.8547310 | 7190 | 3.8567289 |
| 7125 | 3.8527849 | 7158 | 3.8547917 | 7191 | 3.8567893 |
| 7126 | 3.8528458 | 7159 | 3.8548524 | 7192 | 3.8568497 |
| 7127 | 3.8529068 | 7160 | 3.8549130 | 7193 | 3.8569101 |
| 7128 | 3.8529677 | 7161 | 3.8549737 | 7194 | 3.8569704 |
| 7129 | 3.8530286 | 7162 | 3.8550343 | 7195 | 3.8570308 |
| 7130 | 3.8530895 | 7163 | 3.8550950 | 7196 | 3.8570912 |
| 7131 | 3.8531504 | 7164 | 3.8551556 | 7197 | 3.8571515 |
| 7132 | 3.8532113 | 7165 | 3.8552162 | 7198 | 3.8572118 |
| 7133 | 3.8532722 | 7166 | 3.8552768 | 7199 | 3.8572722 |
| 7134 | 3.8533331 | 7167 | 3.8553374 | 2000 | 3.8573325 |

# 7200 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 7201           | 3.8573928 | 7234           | 3.8593785 | 7267           | 3.8613552 |
| 7202           | 3.8574531 | 7235           | 3.8594385 | 7268           | 3.8614149 |
| 7203           | 3.8575134 | 7236           | 3.8594986 | 7269           | 3.8614747 |
| 7204           | 3.8575737 | 7237           | 3.8595586 | 7270           | 3.8615344 |
| 7205           | 3.8576340 | 7238           | 3.8596186 | 7271           | 3.8615941 |
| 7206           | 3.8576943 | 7239           | 3.8596786 | 7272           | 3.8616539 |
| 7207           | 3.8577545 | 7240           | 3.8597386 | 7273           | 3.8617136 |
| 7208           | 3.8578148 | 7241           | 3.8597985 | 7274           | 3.8617733 |
| 7209           | 3.8578750 | 7242           | 3.8598585 | 7275           | 3.8618330 |
| 7210           | 3.8579353 | 7243           | 3.8599185 | 7276           | 3.8618927 |
| 7211           | 3.8579955 | 7244           | 3.8599784 | 7277           | 3.8619524 |
| 7212           | 3.8580557 | 7245           | 3.8600384 | 7278           | 3.8620121 |
| 7213           | 3.8581159 | 7246           | 3.8600983 | 7279           | 3.8620717 |
| 7214           | 3.8581761 | 7247           | 3.8601583 | 7280           | 3.8621314 |
| 7215           | 3.8582363 | 7248           | 3.8602182 | 7281           | 3.8621910 |
| 7216           | 3.8582965 | 7249           | 3.8602781 | 7282           | 3.8622507 |
| 7217           | 3.8583567 | 7250           | 3.8603380 | 7283           | 3.8623103 |
| 7218           | 3.8584169 | 7251           | 3.8603979 | 7284           | 3.8623699 |
| 7219           | 3.8584770 | 7252           | 3.8604578 | 7285           | 3.8624296 |
| 7220           | 3.8585372 | 7253           | 3.8605177 | 7286           | 3.8624892 |
| 7221           | 3.8585973 | 7254           | 3.8605776 | 7287           | 3.8625488 |
| 7222           | 3.8586575 | 7255           | 3.8606374 | 7288           | 3.8626084 |
| 7223           | 3.8587176 | 7256           | 3.8606973 | 7289           | 3.8626680 |
| 7224           | 3.8587777 | 7257           | 3.8607571 | 7290           | 3.8627275 |
| 7225           | 3.8588379 | 7258           | 3.8608170 | 7291           | 3.8627871 |
| 7226           | 3.8588980 | 7259           | 3.8608768 | 7292           | 3.8628467 |
| 7227           | 3.8589581 | 7260           | 3.8609366 | 7293           | 3.8629063 |
| 7228           | 3.8590181 | 7261           | 3.8609964 | 7294           | 3.8629658 |
| 7229           | 3.8590782 | 7262           | 3.8610562 | 7295           | 3.8630253 |
| 7230           | 3.8591383 | 7263           | 3.8611160 | 7296           | 3.8630848 |
| 7231           | 3.8591984 | 7264           | 3.8611758 | 7297           | 3.8631443 |
| 7232           | 3.8592584 | 7265           | 3.8612356 | 7298           | 3.8632039 |
| 7233           | 3.8593185 | 7266           | 3.8612954 | 7299           | 3.8632634 |
| 7234           | 3.8593785 | 7267           | 3.8613552 | 7300           | 3.8633229 |

# 7300. A TABLE OF LOGARITHMS. COSY

| Nº   | Logarithm. | Nº   | Logarithm. | Nº   | Logarithm. |
|------|------------|------|------------|------|------------|
| 7301 | 3.8633823  | 7334 | 3.8653409  | 7367 | 3.8672907  |
| 7302 | 3.8634418  | 7335 | 3.8654001  | 7368 | 3.8673495  |
| 7303 | 3.8635013  | 7336 | 3.8654593  | 7369 | 3.8674086  |
| 7304 | 3.8635608  | 7337 | 3.8655185  | 7370 | 3.8674675  |
| 7305 | 3.8636202  | 7338 | 3.8655777  | 7371 | 3.8675264  |
| 7306 | 3.8636797  | 7339 | 3.8656369  | 7372 | 3.8675853  |
| 7307 | 3.8637391  | 7340 | 3.8656961  | 7373 | 3.8676442  |
| 7308 | 3.8637985  | 7341 | 3.8657552  | 7374 | 3.8677031  |
| 7309 | 3.8638580  | 7342 | 3.8658144  | 7375 | 3.8677620  |
| 7310 | 3.8639174  | 7343 | 3.8658735  | 7376 | 3.8678209  |
| 7311 | 3.8639768  | 7344 | 3.8659327  | 7377 | 3.8678798  |
| 7312 | 3.8640362  | 7345 | 3.8659918  | 7378 | 3.8679387  |
| 7313 | 3.8640956  | 7346 | 3.8660509  | 7379 | 3.8679975  |
| 7314 | 3.8641550  | 7347 | 3.8661100  | 7380 | 3.8680564  |
| 7315 | 3.8642143  | 7348 | 3.8661691  | 7381 | 3.8681152  |
| 7316 | 3.8642737  | 7349 | 3.8662282  | 7382 | 3.8681740  |
| 7317 | 3.8643331  | 7350 | 3.8662873  | 7383 | 3.8682329  |
| 7318 | 3.8643924  | 7351 | 3.8663464  | 7384 | 3.8682917  |
| 7319 | 3.8644517  | 7352 | 3.8664055  | 7385 | 3.8683505  |
| 7320 | 3.8645111  | 7353 | 3.8664646  | 7386 | 3.8684093  |
| 7321 | 3.8645704  | 7354 | 3.8665236  | 7387 | 3.8684681  |
| 7322 | 3.8646297  | 7355 | 3.8665827  | 7388 | 3.8685269  |
| 7323 | 3.8646890  | 7356 | 3.8666417  | 7389 | 3.8685857  |
| 7324 | 3.8647483  | 7357 | 3.8667008  | 7390 | 3.8686444  |
| 7325 | 3.8648076  | 7358 | 3.8667598  | 7391 | 3.8687032  |
| 7326 | 3.8048669  | 7359 | 3.8668188  | 7392 | 3.8687620  |
| 7327 | 3.8649262  | 7360 | 3.8668778  | 7393 | 3.8688207  |
| 7328 | 3.8649855  | 7361 | 3.8669368  | 7394 | 3.8688794  |
| 7329 | 3.8650447  | 7362 | 3.8669958  | 7395 | 3.8689382  |
| 7330 | 3.8651040  | 7363 | 3.8670548  | 7396 | 3.8689969  |
| 7331 | 3.8651632  | 7364 | 3.8671138  | 7397 | 3.8690556  |
| 7332 | 3.8652225  | 7365 | 3.8671728  | 7398 | 3.8691143  |
| 7333 | 3.8652817  | 7366 | 3.8672317  | 7399 | 3.8691730  |
| 7334 | 3.8653409  | 7367 | 3.8672907  | 7400 | 3.8692317  |

7400.



# 7400. A TABLE OF LOGARITHMS.

| No.  | Logarithm. | No.  | Logarithm. | No.  | Logarithm. |
|------|------------|------|------------|------|------------|
| 7401 | 3.8692904  | 7434 | 3.8712226  | 7467 | 3.8731462  |
| 7402 | 3.8693491  | 7435 | 3.8712810  | 7468 | 3.8732043  |
| 7403 | 3.8694077  | 7436 | 3.8713394  | 7469 | 3.8732625  |
| 7404 | 3.8694664  | 7437 | 3.8713978  | 7470 | 3.8733206  |
| 7405 | 3.8695251  | 7438 | 3.8714562  | 7471 | 3.8733787  |
| 7406 | 3.8695837  | 7439 | 3.8715146  | 7472 | 3.8734369  |
| 7407 | 3.8696423  | 7440 | 3.8715729  | 7473 | 3.8734950  |
| 7408 | 3.8697010  | 7441 | 3.8716313  | 7474 | 3.8735531  |
| 7409 | 3.8697596  | 7442 | 3.8716897  | 7475 | 3.8736112  |
| 7410 | 3.8698182  | 7443 | 3.8717480  | 7476 | 3.8736693  |
| 7411 | 3.8698768  | 7444 | 3.8718064  | 7477 | 3.8737274  |
| 7412 | 3.8699354  | 7445 | 3.8718647  | 7478 | 3.8737855  |
| 7413 | 3.8699940  | 7446 | 3.8719230  | 7479 | 3.8738435  |
| 7414 | 3.8700526  | 7447 | 3.8719814  | 7480 | 3.8739016  |
| 7415 | 3.8701112  | 7448 | 3.8720397  | 7481 | 3.8739597  |
| 7416 | 3.8701697  | 7449 | 3.8720980  | 7482 | 3.8740177  |
| 7417 | 3.8702283  | 7450 | 3.8721563  | 7483 | 3.8740757  |
| 7418 | 3.8702868  | 7451 | 3.8722146  | 7484 | 3.8741338  |
| 7419 | 3.8703454  | 7452 | 3.8722728  | 7485 | 3.8741918  |
| 7420 | 3.8704039  | 7453 | 3.8723311  | 7486 | 3.8742498  |
| 7421 | 3.8704624  | 7454 | 3.8723894  | 7487 | 3.8743078  |
| 7422 | 3.8705210  | 7455 | 3.8724476  | 7488 | 3.8743658  |
| 7423 | 3.8705794  | 7456 | 3.8725059  | 7489 | 3.8744238  |
| 7424 | 3.8706380  | 7457 | 3.8725641  | 7490 | 3.8744818  |
| 7425 | 3.8706965  | 7458 | 3.8726224  | 7491 | 3.8745398  |
| 7426 | 3.8707549  | 7459 | 3.8726806  | 7492 | 3.8745978  |
| 7427 | 3.8708134  | 7460 | 3.8727388  | 7493 | 3.8746557  |
| 7428 | 3.8708719  | 7461 | 3.8727970  | 7494 | 3.8747137  |
| 7429 | 3.8709304  | 7462 | 3.8728552  | 7495 | 3.8747716  |
| 7430 | 3.8709888  | 7463 | 3.8729134  | 7496 | 3.8748296  |
| 7431 | 3.8710473  | 7464 | 3.8729716  | 7497 | 3.8748875  |
| 7432 | 3.8711057  | 7465 | 3.8730298  | 7498 | 3.8749454  |
| 7433 | 3.8711641  | 7466 | 3.8730880  | 7499 | 3.8750034  |
| 7434 | 3.8712226  | 7467 | 3.8731462  | 7500 | 3.8750613  |

# 7500. A TABLE of LOGARITHMS. 0017

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 7501           | 3.8751192 | 7534           | 3.8770256 | 7567           | 3.8789237 |
| 7502           | 3.8751771 | 7535           | 3.8770833 | 7568           | 3.8789811 |
| 7503           | 3.8752349 | 7536           | 3.8771409 | 7569           | 3.8790385 |
| 7504           | 3.8752928 | 7537           | 3.8771985 | 7570           | 3.8790959 |
| 7505           | 3.8753507 | 7538           | 3.8772561 | 7571           | 3.8791532 |
| 7506           | 3.8754086 | 7539           | 3.8773137 | 7572           | 3.8792106 |
| 7507           | 3.8754664 | 7540           | 3.8773713 | 7573           | 3.8792680 |
| 7508           | 3.8755243 | 7541           | 3.8774289 | 7574           | 3.8793253 |
| 7509           | 3.8755821 | 7542           | 3.8774865 | 7575           | 3.8793826 |
| 7510           | 3.8756399 | 7543           | 3.8775441 | 7576           | 3.8794400 |
| 7511           | 3.8756978 | 7544           | 3.8776017 | 7577           | 3.8794973 |
| 7512           | 3.8757556 | 7545           | 3.8776592 | 7578           | 3.8795546 |
| 7513           | 3.8758134 | 7546           | 3.8777168 | 7579           | 3.8796119 |
| 7514           | 3.8758712 | 7547           | 3.8777743 | 7580           | 3.8796692 |
| 7515           | 3.8759290 | 7548           | 3.8778319 | 7581           | 3.8797265 |
| 7516           | 3.8759868 | 7549           | 3.8778894 | 7582           | 3.8797838 |
| 7517           | 3.8760445 | 7550           | 3.8779470 | 7583           | 3.8798411 |
| 7518           | 3.8761023 | 7551           | 3.8780045 | 7584           | 3.8798983 |
| 7519           | 3.8761601 | 7552           | 3.8780620 | 7585           | 3.8799556 |
| 7520           | 3.8762178 | 7553           | 3.8781195 | 7586           | 3.8800128 |
| 7521           | 3.8762756 | 7554           | 3.8781770 | 7587           | 3.8800701 |
| 7522           | 3.8763333 | 7555           | 3.8782345 | 7588           | 3.8801273 |
| 7523           | 3.8763911 | 7556           | 3.8782919 | 7589           | 3.8801846 |
| 7524           | 3.8764488 | 7557           | 3.8783494 | 7590           | 3.8802418 |
| 7525           | 3.8765065 | 7558           | 3.8784069 | 7591           | 3.8802990 |
| 7526           | 3.8765642 | 7559           | 3.8784643 | 7592           | 3.8803562 |
| 7527           | 3.8766219 | 7560           | 3.8785218 | 7593           | 3.8804134 |
| 7528           | 3.8766796 | 7561           | 3.8785792 | 7594           | 3.8804706 |
| 7529           | 3.8767373 | 7562           | 3.8786367 | 7595           | 3.8805278 |
| 7530           | 3.8767950 | 7563           | 3.8786941 | 7596           | 3.8805850 |
| 7531           | 3.8768526 | 7564           | 3.8787515 | 7597           | 3.8806421 |
| 7532           | 3.8769103 | 7565           | 3.8788089 | 7598           | 3.8806993 |
| 7533           | 3.8769680 | 7566           | 3.8788663 | 7599           | 3.8807564 |
| 7534           | 3.8770256 | 7567           | 3.8789237 | 7600           | 3.8808136 |

# 7600 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 7601           | 3.8808707 | 7634           | 3.8827522 | 7667           | 3.8846255 |
| 7602           | 3.8809279 | 7635           | 3.8828090 | 7668           | 3.8846821 |
| 7603           | 3.8809850 | 7636           | 3.8828659 | 7669           | 3.8847387 |
| 7604           | 3.8810421 | 7637           | 3.8829228 | 7670           | 3.8847954 |
| 7605           | 3.8810992 | 7638           | 3.8829797 | 7671           | 3.8848520 |
| 7606           | 3.8811563 | 7639           | 3.8830365 | 7672           | 3.8849086 |
| 7607           | 3.8812134 | 7640           | 3.8830934 | 7673           | 3.8849652 |
| 7608           | 3.8812705 | 7641           | 3.8831502 | 7674           | 3.8850218 |
| 7609           | 3.8813276 | 7642           | 3.8832070 | 7675           | 3.8850784 |
| 7610           | 3.8813847 | 7643           | 3.8832639 | 7676           | 3.8851350 |
| 7611           | 3.8814417 | 7644           | 3.8833207 | 7677           | 3.8851915 |
| 7612           | 3.8814988 | 7645           | 3.8833775 | 7678           | 3.8852481 |
| 7613           | 3.8815558 | 7646           | 3.8834343 | 7679           | 3.8853047 |
| 7614           | 3.8816129 | 7647           | 3.8834911 | 7680           | 3.8853612 |
| 7615           | 3.8816699 | 7648           | 3.8835479 | 7681           | 3.8854178 |
| 7616           | 3.8817269 | 7649           | 3.8836047 | 7682           | 3.8854743 |
| 7617           | 3.8817840 | 7650           | 3.8836614 | 7683           | 3.8855308 |
| 7618           | 3.8818410 | 7651           | 3.8837182 | 7684           | 3.8855874 |
| 7619           | 3.8818980 | 7652           | 3.8837750 | 7685           | 3.8856439 |
| 7620           | 3.8819550 | 7653           | 3.8838317 | 7686           | 3.8857004 |
| 7621           | 3.8820120 | 7654           | 3.8838885 | 7687           | 3.8857569 |
| 7622           | 3.8820689 | 7655           | 3.8839452 | 7688           | 3.8858134 |
| 7623           | 3.8821259 | 7656           | 3.8840019 | 7689           | 3.8858699 |
| 7624           | 3.8821829 | 7657           | 3.8840586 | 7690           | 3.8859263 |
| 7625           | 3.8822398 | 7658           | 3.8841154 | 7691           | 3.8859828 |
| 7626           | 3.8822968 | 7659           | 3.8841721 | 7692           | 3.8860393 |
| 7627           | 3.8823537 | 7660           | 3.8842288 | 7693           | 3.8860957 |
| 7628           | 3.8824107 | 7661           | 3.8842855 | 7694           | 3.8861522 |
| 7629           | 3.8824676 | 7662           | 3.8843421 | 7695           | 3.8862086 |
| 7630           | 3.8825245 | 7663           | 3.8843988 | 7696           | 3.8862651 |
| 7631           | 3.8825815 | 7664           | 3.8844555 | 7697           | 3.8863215 |
| 7632           | 3.8826384 | 7665           | 3.8845122 | 7698           | 3.8863779 |
| 7633           | 3.8826953 | 7666           | 3.8845688 | 7699           | 3.8864343 |
| 7634           | 3.8827522 | 7667           | 3.8846255 | 7700           | 3.8864907 |



# 7700 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 7701           | 3.8865471 | 7734           | 3.8884042 | 7767           | 3.8902533 |
| 7702           | 3.8866035 | 7735           | 3.8884603 | 7768           | 3.8903092 |
| 7703           | 3.8866599 | 7736           | 3.8885165 | 7769           | 3.8903651 |
| 7704           | 3.8867163 | 7737           | 3.8885726 | 7770           | 3.8904210 |
| 7705           | 3.8867726 | 7738           | 3.8886287 | 7771           | 3.8904769 |
| 7706           | 3.8868290 | 7739           | 3.8886848 | 7772           | 3.8905328 |
| 7707           | 3.8868854 | 7740           | 3.8887410 | 7773           | 3.8905887 |
| 7708           | 3.8869417 | 7741           | 3.8887971 | 7774           | 3.8906445 |
| 7709           | 3.8869980 | 7742           | 3.8888532 | 7775           | 3.8907004 |
| 7710           | 3.8870544 | 7743           | 3.8889093 | 7776           | 3.8907563 |
| 7711           | 3.8871107 | 7744           | 3.8889653 | 7777           | 3.8908121 |
| 7712           | 3.8871670 | 7745           | 3.8890214 | 7778           | 3.8908679 |
| 7713           | 3.8872233 | 7746           | 3.8890775 | 7779           | 3.8909238 |
| 7714           | 3.8872796 | 7747           | 3.8891336 | 7780           | 3.8909796 |
| 7715           | 3.8873359 | 7748           | 3.8891896 | 7781           | 3.8910354 |
| 7716           | 3.8873922 | 7749           | 3.8892457 | 7782           | 3.8910912 |
| 7717           | 3.8874485 | 7750           | 3.8893017 | 7783           | 3.8911470 |
| 7718           | 3.8875048 | 7751           | 3.8893577 | 7784           | 3.8912028 |
| 7719           | 3.8875610 | 7752           | 3.8894138 | 7785           | 3.8912586 |
| 7720           | 3.8876173 | 7753           | 3.8894698 | 7786           | 3.8913144 |
| 7721           | 3.8876736 | 7754           | 3.8895258 | 7787           | 3.8913702 |
| 7722           | 3.8877298 | 7755           | 3.8895818 | 7788           | 3.8914259 |
| 7723           | 3.8877860 | 7756           | 3.8896378 | 7789           | 3.8914817 |
| 7724           | 3.8878423 | 7757           | 3.8896938 | 7790           | 3.8915375 |
| 7725           | 3.8878985 | 7758           | 3.8897498 | 7791           | 3.8915932 |
| 7726           | 3.8879547 | 7759           | 3.8898058 | 7792           | 3.8916489 |
| 7727           | 3.8880109 | 7760           | 3.8898617 | 7793           | 3.8917047 |
| 7728           | 3.8880671 | 7761           | 3.8899177 | 7794           | 3.8917604 |
| 7729           | 3.8881233 | 7762           | 3.8899736 | 7795           | 3.8918161 |
| 7730           | 3.8881795 | 7763           | 3.8900296 | 7796           | 3.8918718 |
| 7731           | 3.8882357 | 7764           | 3.8900855 | 7797           | 3.8919275 |
| 7732           | 3.8882918 | 7765           | 3.8901415 | 7798           | 3.8919832 |
| 7733           | 3.8883480 | 7766           | 3.8901974 | 7799           | 3.8920389 |
| 7734           | 3.8884042 | 7767           | 3.8902533 | 7800           | 3.8920946 |

# 7800 A TABLE OF LOGARITHMS. 0097

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 7801           | 3.8921563 | 7834           | 3.8939836 | 7867           | 3.8958092 |
| 7802           | 3.8922059 | 7835           | 3.8940390 | 7868           | 3.8958644 |
| 7803           | 3.8922616 | 7836           | 3.8940944 | 7869           | 3.8959195 |
| 7804           | 3.8923173 | 7837           | 3.8941498 | 7870           | 3.8959748 |
| 7805           | 3.8923729 | 7838           | 3.8942053 | 7871           | 3.8960299 |
| 7806           | 3.8924285 | 7839           | 3.8942607 | 7872           | 3.8960851 |
| 7807           | 3.8924842 | 7840           | 3.8943161 | 7873           | 3.8961403 |
| 7808           | 3.8925398 | 7841           | 3.8943715 | 7874           | 3.8961954 |
| 7809           | 3.8925954 | 7842           | 3.8944268 | 7875           | 3.8962506 |
| 7810           | 3.8926510 | 7843           | 3.8944822 | 7876           | 3.8963057 |
| 7811           | 3.8927066 | 7844           | 3.8945376 | 7877           | 3.8963608 |
| 7812           | 3.8927622 | 7845           | 3.8945929 | 7878           | 3.8964160 |
| 7813           | 3.8928178 | 7846           | 3.8946483 | 7879           | 3.8964711 |
| 7814           | 3.8928734 | 7847           | 3.8947037 | 7880           | 3.8965262 |
| 7815           | 3.8929290 | 7848           | 3.8947590 | 7881           | 3.8965813 |
| 7816           | 3.8929846 | 7849           | 3.8948143 | 7882           | 3.8966364 |
| 7817           | 3.8930401 | 7850           | 3.8948697 | 7883           | 3.8966915 |
| 7818           | 3.8930957 | 7851           | 3.8949250 | 7884           | 3.8967466 |
| 7819           | 3.8931512 | 7852           | 3.8949803 | 7885           | 3.8968017 |
| 7820           | 3.8932068 | 7853           | 3.8950356 | 7886           | 3.8968568 |
| 7821           | 3.8932623 | 7854           | 3.8950909 | 7887           | 3.8969118 |
| 7822           | 3.8933178 | 7855           | 3.8951462 | 7888           | 3.8969669 |
| 7823           | 3.8933733 | 7856           | 3.8952015 | 7889           | 3.8970220 |
| 7824           | 3.8934288 | 7857           | 3.8952568 | 7890           | 3.8970770 |
| 7825           | 3.8934843 | 7858           | 3.8953120 | 7891           | 3.8971320 |
| 7826           | 3.8935398 | 7859           | 3.8953673 | 7892           | 3.8971871 |
| 7827           | 3.8935953 | 7860           | 3.8954225 | 7893           | 3.8972421 |
| 7828           | 3.8936508 | 7861           | 3.8954778 | 7894           | 3.8972971 |
| 7829           | 3.8937063 | 7862           | 3.8955330 | 7895           | 3.8973521 |
| 7830           | 3.8937618 | 7863           | 3.8955883 | 7896           | 3.8974071 |
| 7831           | 3.8938172 | 7864           | 3.8956435 | 7897           | 3.8974621 |
| 7832           | 3.8938727 | 7865           | 3.8956987 | 7898           | 3.8975171 |
| 7833           | 3.8939281 | 7866           | 3.8957539 | 7899           | 3.8975721 |
| 7834           | 3.8939836 | 7867           | 3.8958092 | 7900           | 3.8976271 |

# 7900. A TABLE OF LOGARITHMS. 8000

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 7901           | 3.8976821 | 7934           | 3.8994922 | 7967           | 3.9012948 |
| 7902           | 3.8977370 | 7935           | 3.8995469 | 7968           | 3.9013493 |
| 7903           | 3.8977920 | 7936           | 3.8996017 | 7969           | 3.9014038 |
| 7904           | 3.8978469 | 7937           | 3.8996564 | 7970           | 3.9014583 |
| 7905           | 3.8979019 | 7938           | 3.8997111 | 7971           | 3.9015128 |
| 7906           | 3.8979568 | 7939           | 3.8997658 | 7972           | 3.9015673 |
| 7907           | 3.8980117 | 7940           | 3.8998205 | 7973           | 3.9016218 |
| 7908           | 3.8980667 | 7941           | 3.8998752 | 7974           | 3.9016762 |
| 7909           | 3.8981216 | 7942           | 3.8999299 | 7975           | 3.9017307 |
| 7910           | 3.8981765 | 7943           | 3.8999846 | 7976           | 3.9017851 |
| 7911           | 3.8982314 | 7944           | 3.9000392 | 7977           | 3.9018396 |
| 7912           | 3.8982863 | 7945           | 3.9000939 | 7978           | 3.9018940 |
| 7913           | 3.8983412 | 7946           | 3.9001486 | 7979           | 3.9019485 |
| 7914           | 3.8983960 | 7947           | 3.9002032 | 7980           | 3.9020029 |
| 7915           | 3.8984509 | 7948           | 3.9002579 | 7981           | 3.9020573 |
| 7916           | 3.8985058 | 7949           | 3.9003125 | 7982           | 3.9021117 |
| 7917           | 3.8985606 | 7950           | 3.9003671 | 7983           | 3.9021661 |
| 7918           | 3.8986155 | 7951           | 3.9004218 | 7984           | 3.9022205 |
| 7919           | 3.8986703 | 7952           | 3.9004764 | 7985           | 3.9022749 |
| 7920           | 3.8987252 | 7953           | 3.9005310 | 7986           | 3.9023293 |
| 7921           | 3.8987800 | 7954           | 3.9005856 | 7987           | 3.9023837 |
| 7922           | 3.8988348 | 7955           | 3.9006402 | 7988           | 3.9024381 |
| 7923           | 3.8988897 | 7956           | 3.9006948 | 7989           | 3.9024924 |
| 7924           | 3.8989445 | 7957           | 3.9007494 | 7990           | 3.9025468 |
| 7925           | 3.8989993 | 7958           | 3.9008039 | 7991           | 3.9026011 |
| 7926           | 3.8990541 | 7959           | 3.9008585 | 7992           | 3.9026555 |
| 7927           | 3.8991089 | 7960           | 3.9009131 | 7993           | 3.9027098 |
| 7928           | 3.8991636 | 7961           | 3.9009676 | 7994           | 3.9027641 |
| 7929           | 3.8992184 | 7962           | 3.9010222 | 7995           | 3.9028185 |
| 7930           | 3.8992732 | 7963           | 3.9010767 | 7996           | 3.9028728 |
| 7931           | 3.8993279 | 7964           | 3.9011313 | 7997           | 3.9029271 |
| 7932           | 3.8993827 | 7965           | 3.9011858 | 7998           | 3.9029814 |
| 7933           | 3.8994375 | 7966           | 3.9012403 | 7999           | 3.9030357 |
| 7934           | 3.8994922 | 7967           | 3.9012948 | 8000           | 3.9030900 |



# 8000 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 8001           | 3.9031443 | 8034           | 3.9049318 | 8067           | 3.9067121 |
| 8002           | 3.9031985 | 8035           | 3.9049859 | 8068           | 3.9067659 |
| 8003           | 3.9032528 | 8036           | 3.9050399 | 8069           | 3.9068197 |
| 8004           | 3.9033071 | 8037           | 3.9050940 | 8070           | 3.9068735 |
| 8005           | 3.9033613 | 8038           | 3.9051480 | 8071           | 3.9069273 |
| 8006           | 3.9034156 | 8039           | 3.9052020 | 8072           | 3.9069812 |
| 8007           | 3.9034698 | 8040           | 3.9052560 | 8073           | 3.9070350 |
| 8008           | 3.9035241 | 8041           | 3.9053101 | 8074           | 3.9070887 |
| 8009           | 3.9035783 | 8042           | 3.9053641 | 8075           | 3.9071425 |
| 8010           | 3.9036325 | 8043           | 3.9054181 | 8076           | 3.9071963 |
| 8011           | 3.9036867 | 8044           | 3.9054721 | 8077           | 3.9072501 |
| 8012           | 3.9037409 | 8045           | 3.9055260 | 8078           | 3.9073038 |
| 8013           | 3.9037951 | 8046           | 3.9055800 | 8079           | 3.9073576 |
| 8014           | 3.9038493 | 8047           | 3.9056340 | 8080           | 3.9074114 |
| 8015           | 3.9039035 | 8048           | 3.9056880 | 8081           | 3.9074651 |
| 8016           | 3.9039577 | 8049           | 3.9057419 | 8082           | 3.9075188 |
| 8017           | 3.9040119 | 8050           | 3.9057959 | 8083           | 3.9075726 |
| 8018           | 3.9040661 | 8051           | 3.9058498 | 8084           | 3.9076263 |
| 8019           | 3.9041202 | 8052           | 3.9059038 | 8085           | 3.9076801 |
| 8020           | 3.9041744 | 8053           | 3.9059577 | 8086           | 3.9077337 |
| 8021           | 3.9042285 | 8054           | 3.9060116 | 8087           | 3.9077874 |
| 8022           | 3.9042827 | 8055           | 3.9060655 | 8088           | 3.9078411 |
| 8023           | 3.9043368 | 8056           | 3.9061195 | 8089           | 3.9078948 |
| 8024           | 3.9043909 | 8057           | 3.9061734 | 8090           | 3.9079485 |
| 8025           | 3.9044450 | 8058           | 3.9062273 | 8091           | 3.9080022 |
| 8026           | 3.9044992 | 8059           | 3.9062812 | 8092           | 3.9080559 |
| 8027           | 3.9045533 | 8060           | 3.9063350 | 8093           | 3.9081095 |
| 8028           | 3.9046074 | 8061           | 3.9063889 | 8094           | 3.9081632 |
| 8029           | 3.9046615 | 8062           | 3.9064428 | 8095           | 3.9082169 |
| 8030           | 3.9047155 | 8063           | 3.9064967 | 8096           | 3.9082705 |
| 8031           | 3.9047696 | 8064           | 3.9065505 | 8097           | 3.9083241 |
| 8032           | 3.9048237 | 8065           | 3.9066044 | 8098           | 3.9083778 |
| 8033           | 3.9048778 | 8066           | 3.9066582 | 8099           | 3.9084314 |
| 8034           | 3.9049318 | 8067           | 3.9067121 | 8100           | 3.9084850 |

8100

# 8100 A TABLE of LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 8101           | 3.9085386 | 8134           | 3.9103042 | 8167           | 3.9120626 |
| 8102           | 3.9085922 | 8135           | 3.9103576 | 8168           | 3.9121157 |
| 8103           | 3.9086458 | 8136           | 3.9104109 | 8169           | 3.9121689 |
| 8104           | 3.9086994 | 8137           | 3.9104643 | 8170           | 3.9122221 |
| 8105           | 3.9087530 | 8138           | 3.9105177 | 8171           | 3.9122752 |
| 8106           | 3.9088066 | 8139           | 3.9105710 | 8172           | 3.9123284 |
| 8107           | 3.9088602 | 8140           | 3.9106244 | 8173           | 3.9123815 |
| 8108           | 3.9089137 | 8141           | 3.9106778 | 8174           | 3.9124346 |
| 8109           | 3.9089673 | 8142           | 3.9107311 | 8175           | 3.9124878 |
| 8110           | 3.9090209 | 8143           | 3.9107844 | 8176           | 3.9125409 |
| 8111           | 3.9090744 | 8144           | 3.9108378 | 8177           | 3.9125940 |
| 8112           | 3.9091279 | 8145           | 3.9108911 | 8178           | 3.9126471 |
| 8113           | 3.9091815 | 8146           | 3.9109444 | 8179           | 3.9127002 |
| 8114           | 3.9092350 | 8147           | 3.9109977 | 8180           | 3.9127533 |
| 8115           | 3.9092885 | 8148           | 3.9110510 | 8181           | 3.9128064 |
| 8116           | 3.9093420 | 8149           | 3.9111043 | 8182           | 3.9128595 |
| 8117           | 3.9093955 | 8150           | 3.9111576 | 8183           | 3.9129126 |
| 8118           | 3.9094490 | 8151           | 3.9112109 | 8184           | 3.9129656 |
| 8119           | 3.9095025 | 8152           | 3.9112642 | 8185           | 3.9130187 |
| 8120           | 3.9095560 | 8153           | 3.9113174 | 8186           | 3.9130717 |
| 8121           | 3.9096095 | 8154           | 3.9113707 | 8187           | 3.9131248 |
| 8122           | 3.9096630 | 8155           | 3.9114240 | 8188           | 3.9131778 |
| 8123           | 3.9097165 | 8156           | 3.9114772 | 8189           | 3.9132309 |
| 8124           | 3.9097699 | 8157           | 3.9115305 | 8190           | 3.9132839 |
| 8125           | 3.9098234 | 8158           | 3.9115837 | 8191           | 3.9133369 |
| 8126           | 3.9098768 | 8159           | 3.9116369 | 8192           | 3.9133899 |
| 8127           | 3.9099303 | 8160           | 3.9116902 | 8193           | 3.9134430 |
| 8128           | 3.9099837 | 8161           | 3.9117434 | 8194           | 3.9134960 |
| 8129           | 3.9100371 | 8162           | 3.9117966 | 8195           | 3.9135490 |
| 8130           | 3.9100905 | 8163           | 3.9118498 | 8196           | 3.9136019 |
| 8131           | 3.9101440 | 8164           | 3.9119030 | 8197           | 3.9136549 |
| 8132           | 3.9101974 | 8165           | 3.9119562 | 8198           | 3.9137079 |
| 8133           | 3.9102508 | 8166           | 3.9120094 | 8199           | 3.9137609 |
| 8134           | 3.9103042 | 8167           | 3.9120626 | 8200           | 3.9138139 |

## 8200 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 8201           | 3.9138068 | 8234           | 3.9156109 | 8267           | 3.9173479 |
| 8202           | 3.9139198 | 8235           | 3.9156636 | 8268           | 3.9174005 |
| 8203           | 3.9139727 | 8236           | 3.9157163 | 8269           | 3.9174530 |
| 8204           | 3.9140257 | 8237           | 3.9157691 | 8270           | 3.9175055 |
| 8205           | 3.9140786 | 8238           | 3.9158218 | 8271           | 3.9175580 |
| 8206           | 3.9141315 | 8239           | 3.9158745 | 8272           | 3.9176105 |
| 8207           | 3.9141844 | 8240           | 3.9159272 | 8273           | 3.9176630 |
| 8208           | 3.9142373 | 8241           | 3.9159799 | 8274           | 3.9177155 |
| 8209           | 3.9142903 | 8242           | 3.9160326 | 8275           | 3.9177680 |
| 8210           | 3.9143432 | 8243           | 3.9160853 | 8276           | 3.9178205 |
| 8211           | 3.9143961 | 8244           | 3.9161380 | 8277           | 3.9178730 |
| 8212           | 3.9144489 | 8245           | 3.9161907 | 8278           | 3.9179254 |
| 8213           | 3.9145018 | 8246           | 3.9162433 | 8279           | 3.9179779 |
| 8214           | 3.9145547 | 8247           | 3.9162960 | 8280           | 3.9180303 |
| 8215           | 3.9146076 | 8248           | 3.9163487 | 8281           | 3.9180828 |
| 8216           | 3.9146604 | 8249           | 3.9164013 | 8282           | 3.9181352 |
| 8217           | 3.9147134 | 8250           | 3.9164539 | 8283           | 3.9181877 |
| 8218           | 3.9147661 | 8251           | 3.9165066 | 8284           | 3.9182401 |
| 8219           | 3.9148190 | 8252           | 3.9165592 | 8285           | 3.9182925 |
| 8220           | 3.9148718 | 8253           | 3.9166118 | 8286           | 3.9183449 |
| 8221           | 3.9149246 | 8254           | 3.9166645 | 8287           | 3.9183973 |
| 8222           | 3.9149775 | 8255           | 3.9167171 | 8288           | 3.9184497 |
| 8223           | 3.9150303 | 8256           | 3.9167697 | 8289           | 3.9185021 |
| 8224           | 3.9150831 | 8257           | 3.9168223 | 8290           | 3.9185545 |
| 8225           | 3.9151359 | 8258           | 3.9168749 | 8291           | 3.9186069 |
| 8226           | 3.9151887 | 8259           | 3.9169275 | 8292           | 3.9186593 |
| 8227           | 3.9152415 | 8260           | 3.9169800 | 8293           | 3.9187117 |
| 8228           | 3.9152943 | 8261           | 3.9170326 | 8294           | 3.9187640 |
| 8229           | 3.9153471 | 8262           | 3.9170852 | 8295           | 3.9188164 |
| 8230           | 3.9153998 | 8263           | 3.9171378 | 8296           | 3.9188687 |
| 8231           | 3.9154526 | 8264           | 3.9171903 | 8297           | 3.9189211 |
| 8232           | 3.9155054 | 8265           | 3.9172429 | 8298           | 3.9189734 |
| 8233           | 3.9155581 | 8266           | 3.9172954 | 8299           | 3.9190258 |
| 8234           | 3.9156109 | 8267           | 3.9173479 | 8300           | 3.9190781 |



# 8300 A TABLE of LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 8301           | 3.9191304 | 8334           | 3.9208535 | 8367           | 3.9225698 |
| 8302           | 3.9191827 | 8335           | 3.9209056 | 8368           | 3.9226217 |
| 8303           | 3.9192350 | 8336           | 3.9209577 | 8369           | 3.9226736 |
| 8304           | 3.9192873 | 8337           | 3.9210098 | 8370           | 3.9227255 |
| 8305           | 3.9193396 | 8338           | 3.9210619 | 8371           | 3.9227773 |
| 8306           | 3.9193919 | 8339           | 3.9211140 | 8372           | 3.9228292 |
| 8307           | 3.9194442 | 8340           | 3.9211661 | 8373           | 3.9228811 |
| 8308           | 3.9194965 | 8341           | 3.9212181 | 8374           | 3.9229330 |
| 8309           | 3.9195488 | 8342           | 3.9212702 | 8375           | 3.9229848 |
| 8310           | 3.9196010 | 8343           | 3.9213222 | 8376           | 3.9230367 |
| 8311           | 3.9196533 | 8344           | 3.9213743 | 8377           | 3.9230885 |
| 8312           | 3.9197055 | 8345           | 3.9214263 | 8378           | 3.9231404 |
| 8313           | 3.9197578 | 8346           | 3.9214784 | 8379           | 3.9231922 |
| 8314           | 3.9198100 | 8347           | 3.9215304 | 8380           | 3.9232440 |
| 8315           | 3.9198623 | 8348           | 3.9215824 | 8381           | 3.9232958 |
| 8316           | 3.9199145 | 8349           | 3.9216345 | 8382           | 3.9233477 |
| 8317           | 3.9199667 | 8350           | 3.9216865 | 8383           | 3.9233995 |
| 8318           | 3.9200189 | 8351           | 3.9217385 | 8384           | 3.9234513 |
| 8319           | 3.9200711 | 8352           | 3.9217905 | 8385           | 3.9235031 |
| 8320           | 3.9201233 | 8353           | 3.9218425 | 8386           | 3.9235549 |
| 8321           | 3.9201755 | 8354           | 3.9218945 | 8387           | 3.9236066 |
| 8322           | 3.9202277 | 8355           | 3.9219465 | 8388           | 3.9236584 |
| 8323           | 3.9202799 | 8356           | 3.9219984 | 8389           | 3.9237102 |
| 8324           | 3.9203321 | 8357           | 3.9220504 | 8390           | 3.9237620 |
| 8325           | 3.9203842 | 8358           | 3.9221024 | 8391           | 3.9238137 |
| 8326           | 3.9204364 | 8359           | 3.9221543 | 8392           | 3.9238655 |
| 8327           | 3.9204886 | 8360           | 3.9222063 | 8393           | 3.9239172 |
| 8328           | 3.9205407 | 8361           | 3.9222582 | 8394           | 3.9239690 |
| 8329           | 3.9205929 | 8362           | 3.9223102 | 8395           | 3.9240207 |
| 8330           | 3.9206450 | 8363           | 3.9223621 | 8396           | 3.9240724 |
| 8331           | 3.9206971 | 8364           | 3.9224140 | 8397           | 3.9241242 |
| 8332           | 3.9207493 | 8365           | 3.9224659 | 8398           | 3.9241759 |
| 8333           | 3.9208014 | 8366           | 3.9225179 | 8399           | 3.9242276 |
| 8334           | 3.9208535 | 8367           | 3.9225698 | 8400           | 3.9242793 |

# 8400. A TABLE OF LOGARITHMS. 0028

| N <sup>o</sup> . | Logarithm. | N <sup>o</sup> . | Logarithm. | N <sup>o</sup> . | Logarithm. |
|------------------|------------|------------------|------------|------------------|------------|
| 8401             | 3.9243310  | 8434             | 3.9260336  | 8467             | 3.9277296  |
| 8402             | 3.9243827  | 8435             | 3.9260851  | 8468             | 3.9277808  |
| 8403             | 3.9244344  | 8436             | 3.9261366  | 8469             | 3.9278321  |
| 8404             | 3.9244860  | 8437             | 3.9261880  | 8470             | 3.9278834  |
| 8405             | 3.9245377  | 8438             | 3.9262395  | 8471             | 3.9279347  |
| 8406             | 3.9245894  | 8439             | 3.9262910  | 8472             | 3.9279859  |
| 8407             | 3.9246410  | 8440             | 3.9263424  | 8473             | 3.9280372  |
| 8408             | 3.9246927  | 8441             | 3.9263939  | 8474             | 3.9280885  |
| 8409             | 3.9247444  | 8442             | 3.9264453  | 8475             | 3.9281397  |
| 8410             | 3.9247960  | 8443             | 3.9264968  | 8476             | 3.9281909  |
| 8411             | 3.9248475  | 8444             | 3.9265482  | 8477             | 3.9282422  |
| 8412             | 3.9248993  | 8445             | 3.9265997  | 8478             | 3.9282934  |
| 8413             | 3.9249509  | 8446             | 3.9266511  | 8479             | 3.9283446  |
| 8414             | 3.9250023  | 8447             | 3.9267025  | 8480             | 3.9283958  |
| 8415             | 3.9250538  | 8448             | 3.9267539  | 8481             | 3.9284470  |
| 8416             | 3.9251052  | 8449             | 3.9268053  | 8482             | 3.9284983  |
| 8417             | 3.9251567  | 8450             | 3.9268567  | 8483             | 3.9285495  |
| 8418             | 3.9252081  | 8451             | 3.9269081  | 8484             | 3.9286007  |
| 8419             | 3.9252595  | 8452             | 3.9269595  | 8485             | 3.9286519  |
| 8420             | 3.9253110  | 8453             | 3.9270109  | 8486             | 3.9287031  |
| 8421             | 3.9253624  | 8454             | 3.9270622  | 8487             | 3.9287543  |
| 8422             | 3.9254138  | 8455             | 3.9271136  | 8488             | 3.9288055  |
| 8423             | 3.9254652  | 8456             | 3.9271650  | 8489             | 3.9288567  |
| 8424             | 3.9255166  | 8457             | 3.9272163  | 8490             | 3.9289079  |
| 8425             | 3.9255680  | 8458             | 3.9272677  | 8491             | 3.9289591  |
| 8426             | 3.9256194  | 8459             | 3.9273191  | 8492             | 3.9290103  |
| 8427             | 3.9256708  | 8460             | 3.9273704  | 8493             | 3.9290615  |
| 8428             | 3.9257222  | 8461             | 3.9274218  | 8494             | 3.9291127  |
| 8429             | 3.9257736  | 8462             | 3.9274732  | 8495             | 3.9291639  |
| 8430             | 3.9258250  | 8463             | 3.9275246  | 8496             | 3.9292151  |
| 8431             | 3.9258764  | 8464             | 3.9275759  | 8497             | 3.9292663  |
| 8432             | 3.9259278  | 8465             | 3.9276273  | 8498             | 3.9293175  |
| 8433             | 3.9259792  | 8466             | 3.9276787  | 8499             | 3.9293687  |
| 8434             | 3.9260306  | 8467             | 3.9277299  | 8500             | 3.9294199  |

# 8500 A TABLE OF LOGARITHMS. 0048

| Nr.  | Logarithm. | Nr.  | Logarithm. | Nr.  | Logarithm. |
|------|------------|------|------------|------|------------|
| 8501 | 3.9294700  | 8534 | 3.9311526  | 8567 | 3.9328288  |
| 8502 | 3.9295211  | 8535 | 3.9312035  | 8568 | 3.9328795  |
| 8503 | 3.9295722  | 8536 | 3.9312544  | 8569 | 3.9329301  |
| 8504 | 3.9296233  | 8537 | 3.9313053  | 8570 | 3.9329808  |
| 8505 | 3.9296743  | 8538 | 3.9313562  | 8571 | 3.9330315  |
| 8506 | 3.9297254  | 8539 | 3.9314070  | 8572 | 3.9330821  |
| 8507 | 3.9297764  | 8540 | 3.9314579  | 8573 | 3.9331328  |
| 8508 | 3.9298275  | 8541 | 3.9315087  | 8574 | 3.9331835  |
| 8509 | 3.9298785  | 8542 | 3.9315595  | 8575 | 3.9332341  |
| 8510 | 3.9299296  | 8543 | 3.9316104  | 8576 | 3.9332848  |
| 8511 | 3.9299806  | 8544 | 3.9316612  | 8577 | 3.9333354  |
| 8512 | 3.9300316  | 8545 | 3.9317121  | 8578 | 3.9333860  |
| 8513 | 3.9300826  | 8546 | 3.9317629  | 8579 | 3.9334367  |
| 8514 | 3.9301336  | 8547 | 3.9318137  | 8580 | 3.9334873  |
| 8515 | 3.9301847  | 8548 | 3.9318645  | 8581 | 3.9335379  |
| 8516 | 3.9302357  | 8549 | 3.9319153  | 8582 | 3.9335885  |
| 8517 | 3.9302866  | 8550 | 3.9319661  | 8583 | 3.9336391  |
| 8518 | 3.9303376  | 8551 | 3.9320169  | 8584 | 3.9336897  |
| 8519 | 3.9303886  | 8552 | 3.9320677  | 8585 | 3.9337403  |
| 8520 | 3.9304396  | 8553 | 3.9321185  | 8586 | 3.9337909  |
| 8521 | 3.9304906  | 8554 | 3.9321692  | 8587 | 3.9338415  |
| 8522 | 3.9305415  | 8555 | 3.9322200  | 8588 | 3.9338920  |
| 8523 | 3.9305925  | 8556 | 3.9322708  | 8589 | 3.9339426  |
| 8524 | 3.9306434  | 8557 | 3.9323215  | 8590 | 3.9339932  |
| 8525 | 3.9306944  | 8558 | 3.9323723  | 8591 | 3.9340437  |
| 8526 | 3.9307453  | 8559 | 3.9324230  | 8592 | 3.9340943  |
| 8527 | 3.9307963  | 8560 | 3.9324738  | 8593 | 3.9341448  |
| 8528 | 3.9308472  | 8561 | 3.9325245  | 8594 | 3.9341953  |
| 8529 | 3.9308981  | 8562 | 3.9325752  | 8595 | 3.9342459  |
| 8530 | 3.9309490  | 8563 | 3.9326259  | 8596 | 3.9342964  |
| 8531 | 3.9309999  | 8564 | 3.9326767  | 8597 | 3.9343469  |
| 8532 | 3.9310508  | 8565 | 3.9327274  | 8598 | 3.9343974  |
| 8533 | 3.9311017  | 8566 | 3.9327781  | 8599 | 3.9344479  |
| 8534 | 3.9311526  | 8567 | 3.9328288  | 8600 | 3.9344985  |



# 8600 . A TABLE OF LOGARITHMS. 0072

| Nº   | Logarith. | Nº   | Logarith. | Nº   | Logarith. |
|------|-----------|------|-----------|------|-----------|
| 8601 | 3.9345489 | 8634 | 3.9362120 | 8667 | 3.9378688 |
| 8602 | 3.9345994 | 8635 | 3.9362623 | 8668 | 3.9379189 |
| 8603 | 3.9346499 | 8636 | 3.9363126 | 8669 | 3.9379690 |
| 8604 | 3.9347004 | 8637 | 3.9363629 | 8670 | 3.9380191 |
| 8605 | 3.9347509 | 8638 | 3.9364132 | 8671 | 3.9380692 |
| 8606 | 3.9348013 | 8639 | 3.9364635 | 8672 | 3.9381193 |
| 8607 | 3.9348518 | 8640 | 3.9365137 | 8673 | 3.9381693 |
| 8608 | 3.9349023 | 8641 | 3.9365640 | 8674 | 3.9382194 |
| 8609 | 3.9349527 | 8642 | 3.9366143 | 8675 | 3.9382695 |
| 8610 | 3.9350032 | 8643 | 3.9366645 | 8676 | 3.9383195 |
| 8611 | 3.9350536 | 8644 | 3.9367148 | 8677 | 3.9383696 |
| 8612 | 3.9351040 | 8645 | 3.9367650 | 8678 | 3.9384196 |
| 8613 | 3.9351544 | 8646 | 3.9368152 | 8679 | 3.9384697 |
| 8614 | 3.9352049 | 8647 | 3.9368655 | 8680 | 3.9385197 |
| 8615 | 3.9352553 | 8648 | 3.9369157 | 8681 | 3.9385698 |
| 8616 | 3.9353057 | 8649 | 3.9369659 | 8682 | 3.9386198 |
| 8617 | 3.9353561 | 8650 | 3.9370161 | 8683 | 3.9386698 |
| 8618 | 3.9354065 | 8651 | 3.9370663 | 8684 | 3.9387198 |
| 8619 | 3.9354569 | 8652 | 3.9371165 | 8685 | 3.9387698 |
| 8620 | 3.9355073 | 8653 | 3.9371667 | 8686 | 3.9388198 |
| 8621 | 3.9355576 | 8654 | 3.9372169 | 8687 | 3.9388698 |
| 8622 | 3.9356080 | 8655 | 3.9372671 | 8688 | 3.9389198 |
| 8623 | 3.9356584 | 8656 | 3.9373172 | 8689 | 3.9389698 |
| 8624 | 3.9357087 | 8657 | 3.9373674 | 8690 | 3.9390198 |
| 8625 | 3.9357591 | 8658 | 3.9374176 | 8691 | 3.9390697 |
| 8626 | 3.9358095 | 8659 | 3.9374677 | 8692 | 3.9391197 |
| 8627 | 3.9358598 | 8660 | 3.9375179 | 8693 | 3.9391697 |
| 8628 | 3.9359101 | 8661 | 3.9375680 | 8694 | 3.9392196 |
| 8629 | 3.9359605 | 8662 | 3.9376182 | 8695 | 3.9392696 |
| 8630 | 3.9360108 | 8663 | 3.9376683 | 8696 | 3.9393195 |
| 8631 | 3.9360611 | 8664 | 3.9377184 | 8697 | 3.9393695 |
| 8632 | 3.9361114 | 8665 | 3.9377686 | 8698 | 3.9394194 |
| 8633 | 3.9361617 | 8666 | 3.9378187 | 8699 | 3.9394693 |
| 8634 | 3.9362120 | 8667 | 3.9378688 | 8700 | 3.9395193 |

# 8700 . A TABLE OF LOGARITHMS. 0000

| Nº   | Logarith. | Nº   | Logarith. | Nº   | Logarith. |
|------|-----------|------|-----------|------|-----------|
| 8701 | 3.9395692 | 8734 | 3.9412132 | 8767 | 3.9428510 |
| 8702 | 3.9396191 | 8735 | 3.9412629 | 8768 | 3.9429005 |
| 8703 | 3.9396690 | 8736 | 3.9413126 | 8769 | 3.9429501 |
| 8704 | 3.9397189 | 8737 | 3.9413623 | 8770 | 3.9429996 |
| 8705 | 3.9397688 | 8738 | 3.9414120 | 8771 | 3.9430491 |
| 8706 | 3.9398187 | 8739 | 3.9414617 | 8772 | 3.9430986 |
| 8707 | 3.9398685 | 8740 | 3.9415114 | 8773 | 3.9431481 |
| 8708 | 3.9399184 | 8741 | 3.9415611 | 8774 | 3.9431976 |
| 8709 | 3.9399683 | 8742 | 3.9416108 | 8775 | 3.9432471 |
| 8710 | 3.9400182 | 8743 | 3.9416605 | 8776 | 3.9432966 |
| 8711 | 3.9400680 | 8744 | 3.9417101 | 8777 | 3.9433461 |
| 8712 | 3.9401179 | 8745 | 3.9417598 | 8778 | 3.9433956 |
| 8713 | 3.9401677 | 8746 | 3.9418095 | 8779 | 3.9434450 |
| 8714 | 3.9402176 | 8747 | 3.9418591 | 8780 | 3.9434945 |
| 8715 | 3.9402674 | 8748 | 3.9419088 | 8781 | 3.9435440 |
| 8716 | 3.9403172 | 8749 | 3.9419584 | 8782 | 3.9435934 |
| 8717 | 3.9403670 | 8750 | 3.9420081 | 8783 | 3.9436429 |
| 8718 | 3.9404169 | 8751 | 3.9420577 | 8784 | 3.9436923 |
| 8719 | 3.9404667 | 8752 | 3.9421073 | 8785 | 3.9437418 |
| 8720 | 3.9405165 | 8753 | 3.9421569 | 8786 | 3.9437912 |
| 8721 | 3.9405663 | 8754 | 3.9422065 | 8787 | 3.9438406 |
| 8722 | 3.9406161 | 8755 | 3.9422562 | 8788 | 3.9438900 |
| 8723 | 3.9406659 | 8756 | 3.9423058 | 8789 | 3.9439395 |
| 8724 | 3.9407157 | 8757 | 3.9423553 | 8790 | 3.9439889 |
| 8725 | 3.9407654 | 8758 | 3.9424049 | 8791 | 3.9440383 |
| 8726 | 3.9408152 | 8759 | 3.9424545 | 8792 | 3.9440877 |
| 8727 | 3.9408650 | 8760 | 3.9425041 | 8793 | 3.9441371 |
| 8728 | 3.9409147 | 8761 | 3.9425537 | 8794 | 3.9441865 |
| 8729 | 3.9409645 | 8762 | 3.9426032 | 8795 | 3.9442358 |
| 8730 | 3.9410142 | 8763 | 3.9426528 | 8796 | 3.9442852 |
| 8731 | 3.9410640 | 8764 | 3.9427024 | 8797 | 3.9443346 |
| 8732 | 3.9411137 | 8765 | 3.9427519 | 8798 | 3.9443840 |
| 8733 | 3.9411635 | 8766 | 3.9428015 | 8799 | 3.9444333 |
| 8734 | 3.9412132 | 8767 | 3.9428510 | 8800 | 3.9444827 |

# 8800 A TABLE OF LOGARITHMS. 0008

| Nº   | Logarith. | Nº   | Logarith. | Nº   | Logarith. |
|------|-----------|------|-----------|------|-----------|
| 8801 | 3.9445320 | 8834 | 3.9461574 | 8867 | 3.9477767 |
| 8802 | 3.9445814 | 8835 | 3.9462066 | 8868 | 3.9478257 |
| 8803 | 3.9446307 | 8836 | 3.9462557 | 8869 | 3.9478747 |
| 8804 | 3.9446800 | 8837 | 3.9463048 | 8870 | 3.9479236 |
| 8805 | 3.9447294 | 8838 | 3.9463540 | 8871 | 3.9479726 |
| 8806 | 3.9447787 | 8839 | 3.9464031 | 8872 | 3.9480215 |
| 8807 | 3.9448280 | 8840 | 3.9464523 | 8873 | 3.9480705 |
| 8808 | 3.9448773 | 8841 | 3.9465014 | 8874 | 3.9481194 |
| 8809 | 3.9449266 | 8842 | 3.9465505 | 8875 | 3.9481684 |
| 8810 | 3.9449759 | 8843 | 3.9465996 | 8876 | 3.9482173 |
| 8811 | 3.9450252 | 8844 | 3.9466487 | 8877 | 3.9482662 |
| 8812 | 3.9450745 | 8845 | 3.9466978 | 8878 | 3.9483151 |
| 8813 | 3.9451238 | 8846 | 3.9467469 | 8879 | 3.9483641 |
| 8814 | 3.9451730 | 8847 | 3.9467960 | 8880 | 3.9484130 |
| 8815 | 3.9452223 | 8848 | 3.9468451 | 8881 | 3.9484619 |
| 8816 | 3.9452710 | 8849 | 3.9468942 | 8882 | 3.9485108 |
| 8817 | 3.9453208 | 8850 | 3.9469433 | 8883 | 3.9485597 |
| 8818 | 3.9453701 | 8851 | 3.9469923 | 8884 | 3.9486085 |
| 8819 | 3.9454193 | 8852 | 3.9470414 | 8885 | 3.9486574 |
| 8820 | 3.9454686 | 8853 | 3.9470905 | 8886 | 3.9487063 |
| 8821 | 3.9455178 | 8854 | 3.9471395 | 8887 | 3.9487552 |
| 8822 | 3.9455671 | 8855 | 3.9471886 | 8888 | 3.9488040 |
| 8823 | 3.9456163 | 8856 | 3.9472376 | 8889 | 3.9488529 |
| 8824 | 3.9456655 | 8857 | 3.9472866 | 8890 | 3.9489018 |
| 8825 | 3.9457147 | 8858 | 3.9473357 | 8891 | 3.9489506 |
| 8826 | 3.9457639 | 8859 | 3.9473847 | 8892 | 3.9489995 |
| 8827 | 3.9458131 | 8860 | 3.9474337 | 8893 | 3.9490483 |
| 8828 | 3.9458623 | 8861 | 3.9474827 | 8894 | 3.9490971 |
| 8829 | 3.9459115 | 8862 | 3.9475317 | 8895 | 3.9491460 |
| 8830 | 3.9459607 | 8863 | 3.9475807 | 8896 | 3.9491948 |
| 8831 | 3.9460099 | 8864 | 3.9476297 | 8897 | 3.9492436 |
| 8832 | 3.9460591 | 8865 | 3.9476787 | 8898 | 3.9492924 |
| 8833 | 3.9461082 | 8866 | 3.9477277 | 8899 | 3.9493412 |
| 8834 | 3.9461574 | 8867 | 3.9477767 | 8900 | 3.9493900 |



# 8900 A TABLE OF LOGARITHMS. 0088

| Nº   | Logarith. | Nº   | Logarith. | Nº   | Logarith. |
|------|-----------|------|-----------|------|-----------|
| 8901 | 3.9494388 | 8934 | 3.9510459 | 8967 | 3.9526472 |
| 8902 | 3.9494876 | 8935 | 3.9510946 | 8968 | 3.9526956 |
| 8903 | 3.9495364 | 8936 | 3.9511432 | 8969 | 3.9527440 |
| 8904 | 3.9495852 | 8937 | 3.9511918 | 8970 | 3.9527924 |
| 8905 | 3.9496339 | 8938 | 3.9512404 | 8971 | 3.9528409 |
| 8906 | 3.9496827 | 8939 | 3.9512889 | 8972 | 3.9528893 |
| 8907 | 3.9497315 | 8940 | 3.9513375 | 8973 | 3.9529377 |
| 8908 | 3.9497802 | 8941 | 3.9513861 | 8974 | 3.9529861 |
| 8909 | 3.9498290 | 8942 | 3.9514347 | 8975 | 3.9530345 |
| 8910 | 3.9498777 | 8943 | 3.9514832 | 8976 | 3.9530828 |
| 8911 | 3.9499264 | 8944 | 3.9515318 | 8977 | 3.9531312 |
| 8912 | 3.9499752 | 8945 | 3.9515803 | 8978 | 3.9531796 |
| 8913 | 3.9500239 | 8946 | 3.9516289 | 8979 | 3.9532280 |
| 8914 | 3.9500726 | 8947 | 3.9516774 | 8980 | 3.9532765 |
| 8915 | 3.9501213 | 8948 | 3.9517260 | 8981 | 3.9533247 |
| 8916 | 3.9501701 | 8949 | 3.9517745 | 8982 | 3.9533731 |
| 8917 | 3.9502188 | 8950 | 3.9518230 | 8983 | 3.9534214 |
| 8918 | 3.9502675 | 8951 | 3.9518716 | 8984 | 3.9534697 |
| 8919 | 3.9503162 | 8952 | 3.9519201 | 8985 | 3.9535181 |
| 8920 | 3.9503649 | 8953 | 3.9519686 | 8986 | 3.9535664 |
| 8921 | 3.9504135 | 8954 | 3.9520171 | 8987 | 3.9536147 |
| 8922 | 3.9504622 | 8955 | 3.9520656 | 8988 | 3.9536631 |
| 8923 | 3.9505109 | 8956 | 3.9521141 | 8989 | 3.9537114 |
| 8924 | 3.9505596 | 8957 | 3.9521626 | 8990 | 3.9537597 |
| 8925 | 3.9506082 | 8958 | 3.9522111 | 8991 | 3.9538080 |
| 8926 | 3.9506569 | 8959 | 3.9522595 | 8992 | 3.9538563 |
| 8927 | 3.9507055 | 8960 | 3.9523080 | 8993 | 3.9539046 |
| 8928 | 3.9507542 | 8961 | 3.9523565 | 8994 | 3.9539529 |
| 8929 | 3.9508028 | 8962 | 3.9524049 | 8995 | 3.9540012 |
| 8930 | 3.9508515 | 8963 | 3.9524534 | 8996 | 3.9540494 |
| 8931 | 3.9509001 | 8964 | 3.9525018 | 8997 | 3.9540977 |
| 8932 | 3.9509487 | 8965 | 3.9525503 | 8998 | 3.9541460 |
| 8933 | 3.9509973 | 8966 | 3.9525987 | 8999 | 3.9541943 |
| 8934 | 3.9510459 | 8967 | 3.9526472 | 9000 | 3.9542425 |

# 9000 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 9001           | 3.9542908 | 9034           | 3.9558801 | 9067           | 3.9574636 |
| 9002           | 3.9543390 | 9035           | 3.9559282 | 9068           | 3.9575115 |
| 9003           | 3.9543873 | 9036           | 3.9559762 | 9069           | 3.9575594 |
| 9004           | 3.9544355 | 9037           | 3.9560243 | 9070           | 3.9576073 |
| 9005           | 3.9544837 | 9038           | 3.9560723 | 9071           | 3.9576552 |
| 9006           | 3.9545319 | 9039           | 3.9561204 | 9072           | 3.9577030 |
| 9007           | 3.9545802 | 9040           | 3.9561684 | 9073           | 3.9577509 |
| 9008           | 3.9546284 | 9041           | 3.9562165 | 9074           | 3.9577988 |
| 9009           | 3.9546766 | 9042           | 3.9562645 | 9075           | 3.9578466 |
| 9010           | 3.9547248 | 9043           | 3.9563125 | 9076           | 3.9578945 |
| 9011           | 3.9547730 | 9044           | 3.9563606 | 9077           | 3.9579423 |
| 9012           | 3.9548212 | 9045           | 3.9564086 | 9078           | 3.9579902 |
| 9013           | 3.9548694 | 9046           | 3.9564566 | 9079           | 3.9580380 |
| 9014           | 3.9549176 | 9047           | 3.9565046 | 9080           | 3.9580858 |
| 9015           | 3.9549657 | 9048           | 3.9565526 | 9081           | 3.9581337 |
| 9016           | 3.9550139 | 9049           | 3.9566006 | 9082           | 3.9581815 |
| 9017           | 3.9550621 | 9050           | 3.9566486 | 9083           | 3.9582293 |
| 9018           | 3.9551102 | 9051           | 3.9566966 | 9084           | 3.9582771 |
| 9019           | 3.9551585 | 9052           | 3.9567445 | 9085           | 3.9583249 |
| 9020           | 3.9552065 | 9053           | 3.9567925 | 9086           | 3.9583727 |
| 9021           | 3.9552547 | 9054           | 3.9568405 | 9087           | 3.9584205 |
| 9022           | 3.9553028 | 9055           | 3.9568885 | 9088           | 3.9584683 |
| 9023           | 3.9553510 | 9056           | 3.9569364 | 9089           | 3.9585161 |
| 9024           | 3.9553991 | 9057           | 3.9569844 | 9090           | 3.9585639 |
| 9025           | 3.9554472 | 9058           | 3.9570323 | 9091           | 3.9586116 |
| 9026           | 3.9554953 | 9059           | 3.9570803 | 9092           | 3.9586594 |
| 9027           | 3.9555434 | 9060           | 3.9571282 | 9093           | 3.9587072 |
| 9028           | 3.9555916 | 9061           | 3.9571761 | 9094           | 3.9587549 |
| 9029           | 3.9556397 | 9062           | 3.9572241 | 9095           | 3.9588027 |
| 9030           | 3.9556878 | 9063           | 3.9572720 | 9096           | 3.9588505 |
| 9031           | 3.9557358 | 9064           | 3.9573199 | 9097           | 3.9588982 |
| 9032           | 3.9557839 | 9065           | 3.9573678 | 9098           | 3.9589459 |
| 9033           | 3.9558320 | 9066           | 3.9574157 | 9099           | 3.9589937 |
| 9034           | 3.9558801 | 9067           | 3.9574636 | 9100           | 3.9590414 |

9100

9100 A TABLE of LOGARITHMS. 0000

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 9101           | 3.9590891 | 9134           | 3.9606610 | 9167           | 3.9622272 |
| 9102           | 3.9591308 | 9135           | 3.9607086 | 9168           | 3.9622746 |
| 9103           | 3.9591845 | 9136           | 3.9607561 | 9169           | 3.9623220 |
| 9104           | 3.9592322 | 9137           | 3.9608036 | 9170           | 3.9623693 |
| 9105           | 3.9592800 | 9138           | 3.9608512 | 9171           | 3.9624167 |
| 9106           | 3.9593276 | 9139           | 3.9608987 | 9172           | 3.9624640 |
| 9107           | 3.9593753 | 9140           | 3.9609462 | 9173           | 3.9625114 |
| 9108           | 3.9594230 | 9141           | 3.9609937 | 9174           | 3.9625587 |
| 9109           | 3.9594707 | 9142           | 3.9610412 | 9175           | 3.9626061 |
| 9110           | 3.9595184 | 9143           | 3.9610887 | 9176           | 3.9626534 |
| 9111           | 3.9595660 | 9144           | 3.9611362 | 9177           | 3.9627007 |
| 9112           | 3.9596137 | 9145           | 3.9611837 | 9178           | 3.9627481 |
| 9113           | 3.9596614 | 9146           | 3.9612312 | 9179           | 3.9627954 |
| 9114           | 3.9597090 | 9147           | 3.9612787 | 9180           | 3.9628427 |
| 9115           | 3.9597567 | 9148           | 3.9613262 | 9181           | 3.9628900 |
| 9116           | 3.9598043 | 9149           | 3.9613736 | 9182           | 3.9629373 |
| 9117           | 3.9598520 | 9150           | 3.9614211 | 9183           | 3.9629846 |
| 9118           | 3.9598996 | 9151           | 3.9614686 | 9184           | 3.9630319 |
| 9119           | 3.9599472 | 9152           | 3.9615160 | 9185           | 3.9630792 |
| 9120           | 3.9599948 | 9153           | 3.9615635 | 9186           | 3.9631264 |
| 9121           | 3.9600425 | 9154           | 3.9616109 | 9187           | 3.9631737 |
| 9122           | 3.9600901 | 9155           | 3.9616583 | 9188           | 3.9632210 |
| 9123           | 3.9601377 | 9156           | 3.9617058 | 9189           | 3.9632683 |
| 9124           | 3.9601853 | 9157           | 3.9617532 | 9190           | 3.9633155 |
| 9125           | 3.9602329 | 9158           | 3.9618006 | 9191           | 3.9633628 |
| 9126           | 3.9602803 | 9159           | 3.9618481 | 9192           | 3.9634100 |
| 9127           | 3.9603281 | 9160           | 3.9618953 | 9193           | 3.9634573 |
| 9128           | 3.9603756 | 9161           | 3.9619429 | 9194           | 3.9635045 |
| 9129           | 3.9604232 | 9162           | 3.9619903 | 9195           | 3.9635517 |
| 9130           | 3.9604708 | 9163           | 3.9620377 | 9196           | 3.9635990 |
| 9131           | 3.9605183 | 9164           | 3.9620851 | 9197           | 3.9636462 |
| 9132           | 3.9605659 | 9165           | 3.9621325 | 9198           | 3.9636934 |
| 9133           | 3.9606135 | 9166           | 3.9621799 | 9199           | 3.9637406 |
| 9134           | 3.9606610 | 9167           | 3.9622272 | 9200           | 3.9637878 |



9200 A TABLE OF LOGARITHMS. 0080

| N <sup>o</sup> . | Logarith. | N <sup>o</sup> . | Logarith. | N <sup>o</sup> . | Logarith. |
|------------------|-----------|------------------|-----------|------------------|-----------|
| 9201             | 3.9638350 | 9234             | 3.9653899 | 9267             | 3.9669392 |
| 9202             | 3.9638822 | 9235             | 3.9654369 | 9268             | 3.9669860 |
| 9203             | 3.9639294 | 9236             | 3.9654839 | 9269             | 3.9670329 |
| 9204             | 3.9639766 | 9237             | 3.9655309 | 9270             | 3.9670797 |
| 9205             | 3.9640238 | 9238             | 3.9655780 | 9271             | 3.9671266 |
| 9206             | 3.9640710 | 9239             | 3.9656250 | 9272             | 3.9671734 |
| 9207             | 3.9641181 | 9240             | 3.9656720 | 9273             | 3.9672203 |
| 9208             | 3.9641653 | 9241             | 3.9657190 | 9274             | 3.9672671 |
| 9209             | 3.9642125 | 9242             | 3.9657660 | 9275             | 3.9673139 |
| 9210             | 3.9642596 | 9243             | 3.9658130 | 9276             | 3.9673607 |
| 9211             | 3.9643068 | 9244             | 3.9658599 | 9277             | 3.9674076 |
| 9212             | 3.9643539 | 9245             | 3.9659069 | 9278             | 3.9674544 |
| 9213             | 3.9644011 | 9246             | 3.9659539 | 9279             | 3.9675012 |
| 9214             | 3.9644482 | 9247             | 3.9660009 | 9280             | 3.9675480 |
| 9215             | 3.9644953 | 9248             | 3.9660478 | 9281             | 3.9675948 |
| 9216             | 3.9645425 | 9249             | 3.9660948 | 9282             | 3.9676416 |
| 9217             | 3.9645896 | 9250             | 3.9661417 | 9283             | 3.9676884 |
| 9218             | 3.9646367 | 9251             | 3.9661887 | 9284             | 3.9677351 |
| 9219             | 3.9646838 | 9252             | 3.9662356 | 9285             | 3.9677819 |
| 9220             | 3.9647309 | 9253             | 3.9662826 | 9286             | 3.9678287 |
| 9221             | 3.9647780 | 9254             | 3.9663295 | 9287             | 3.9678754 |
| 9222             | 3.9648251 | 9255             | 3.9663764 | 9288             | 3.9679222 |
| 9223             | 3.9648722 | 9256             | 3.9664233 | 9289             | 3.9679690 |
| 9224             | 3.9649193 | 9257             | 3.9664703 | 9290             | 3.9680157 |
| 9225             | 3.9649664 | 9258             | 3.9665172 | 9291             | 3.9680625 |
| 9226             | 3.9650135 | 9259             | 3.9665641 | 9292             | 3.9681092 |
| 9227             | 3.9650605 | 9260             | 3.9666110 | 9293             | 3.9681559 |
| 9228             | 3.9651076 | 9261             | 3.9666579 | 9294             | 3.9682027 |
| 9229             | 3.9651547 | 9262             | 3.9667048 | 9295             | 3.9682494 |
| 9230             | 3.9652017 | 9263             | 3.9667517 | 9296             | 3.9682961 |
| 9231             | 3.9652488 | 9264             | 3.9667985 | 9297             | 3.9683428 |
| 9232             | 3.9652958 | 9265             | 3.9668454 | 9298             | 3.9683895 |
| 9233             | 3.9653428 | 9266             | 3.9668923 | 9299             | 3.9684362 |
| 9234             | 3.9653899 | 9267             | 3.9669392 | 9300             | 3.9684829 |

# 9300 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 9301           | 3.9685296 | 9334           | 3.9700678 | 9367           | 3.9716005 |
| 9302           | 3.9685763 | 9335           | 3.9701143 | 9368           | 3.9716469 |
| 9303           | 3.9686230 | 9336           | 3.9701608 | 9369           | 3.9716932 |
| 9304           | 3.9686697 | 9337           | 3.9702074 | 9370           | 3.9717396 |
| 9305           | 3.9687164 | 9338           | 3.9702539 | 9371           | 3.9717859 |
| 9306           | 3.9687630 | 9339           | 3.9703004 | 9372           | 3.9718323 |
| 9307           | 3.9688097 | 9340           | 3.9703469 | 9373           | 3.9718786 |
| 9308           | 3.9688564 | 9341           | 3.9703934 | 9374           | 3.9719249 |
| 9309           | 3.9689030 | 9342           | 3.9704399 | 9375           | 3.9719713 |
| 9310           | 3.9689497 | 9343           | 3.9704863 | 9376           | 3.9720176 |
| 9311           | 3.9689963 | 9344           | 3.9705328 | 9377           | 3.9720639 |
| 9312           | 3.9690430 | 9345           | 3.9705793 | 9378           | 3.9721102 |
| 9313           | 3.9690896 | 9346           | 3.9706258 | 9379           | 3.9721565 |
| 9314           | 3.9691362 | 9347           | 3.9706722 | 9380           | 3.9722028 |
| 9315           | 3.9691829 | 9348           | 3.9707187 | 9381           | 3.9722491 |
| 9316           | 3.9692295 | 9349           | 3.9707652 | 9382           | 3.9722954 |
| 9317           | 3.9692761 | 9350           | 3.9708116 | 9383           | 3.9723417 |
| 9318           | 3.9693227 | 9351           | 3.9708581 | 9384           | 3.9723880 |
| 9319           | 3.9693694 | 9352           | 3.9709045 | 9385           | 3.9724343 |
| 9320           | 3.9694159 | 9353           | 3.9709509 | 9386           | 3.9724805 |
| 9321           | 3.9694625 | 9354           | 3.9709974 | 9387           | 3.9725268 |
| 9322           | 3.9695091 | 9355           | 3.9710438 | 9388           | 3.9725731 |
| 9323           | 3.9695557 | 9356           | 3.9710902 | 9389           | 3.9726193 |
| 9324           | 3.9696023 | 9357           | 3.9711366 | 9390           | 3.9726656 |
| 9325           | 3.9696488 | 9358           | 3.9711830 | 9391           | 3.9727118 |
| 9326           | 3.9696954 | 9359           | 3.9712294 | 9392           | 3.9727581 |
| 9327           | 3.9697420 | 9360           | 3.9712758 | 9393           | 3.9728043 |
| 9328           | 3.9697885 | 9361           | 3.9713222 | 9394           | 3.9728506 |
| 9329           | 3.9698351 | 9362           | 3.9713686 | 9395           | 3.9728968 |
| 9330           | 3.9698816 | 9363           | 3.9714150 | 9396           | 3.9729430 |
| 9331           | 3.9699282 | 9364           | 3.9714614 | 9397           | 3.9729892 |
| 9332           | 3.9699747 | 9365           | 3.9715078 | 9398           | 3.9730354 |
| 9333           | 3.9700213 | 9366           | 3.9715542 | 9399           | 3.9730816 |
| 9334           | 3.9700678 | 9367           | 3.9716005 | 9400           | 3.9731279 |

# 9400 A TABLE OF LOGARITHMS. 0030

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 9401           | 3.9731741 | 9434           | 3.9746959 | 9467           | 3.9762124 |
| 9402           | 3.9732202 | 9435           | 3.9747419 | 9468           | 3.9762582 |
| 9403           | 3.9732664 | 9436           | 3.9747879 | 9469           | 3.9763041 |
| 9404           | 3.9733126 | 9437           | 3.9748340 | 9470           | 3.9763500 |
| 9405           | 3.9733588 | 9438           | 3.9748800 | 9471           | 3.9763958 |
| 9406           | 3.9734050 | 9439           | 3.9749260 | 9472           | 3.9764417 |
| 9407           | 3.9734511 | 9440           | 3.9749720 | 9473           | 3.9764875 |
| 9408           | 3.9734973 | 9441           | 3.9750180 | 9474           | 3.9765334 |
| 9409           | 3.9735435 | 9442           | 3.9750640 | 9475           | 3.9765792 |
| 9410           | 3.9735896 | 9443           | 3.9751100 | 9476           | 3.9766251 |
| 9411           | 3.9736358 | 9444           | 3.9751560 | 9477           | 3.9766709 |
| 9412           | 3.9736819 | 9445           | 3.9752020 | 9478           | 3.9767167 |
| 9413           | 3.9737281 | 9446           | 3.9752479 | 9479           | 3.9767625 |
| 9414           | 3.9737742 | 9447           | 3.9752939 | 9480           | 3.9768083 |
| 9415           | 3.9738203 | 9448           | 3.9753399 | 9481           | 3.9768541 |
| 9416           | 3.9738664 | 9449           | 3.9753858 | 9482           | 3.9769000 |
| 9417           | 3.9739126 | 9450           | 3.9754318 | 9483           | 3.9769458 |
| 9418           | 3.9739587 | 9451           | 3.9754778 | 9484           | 3.9769915 |
| 9419           | 3.9740048 | 9452           | 3.9755237 | 9485           | 3.9770373 |
| 9420           | 3.9740509 | 9453           | 3.9755697 | 9486           | 3.9770831 |
| 9421           | 3.9740970 | 9454           | 3.9756156 | 9487           | 3.9771289 |
| 9422           | 3.9741431 | 9455           | 3.9756615 | 9488           | 3.9771747 |
| 9423           | 3.9741892 | 9456           | 3.9757075 | 9489           | 3.9772204 |
| 9424           | 3.9742353 | 9457           | 3.9757534 | 9490           | 3.9772662 |
| 9425           | 3.9742814 | 9458           | 3.9757993 | 9491           | 3.9773120 |
| 9426           | 3.9743274 | 9459           | 3.9758452 | 9492           | 3.9773577 |
| 9427           | 3.9743735 | 9460           | 3.9758911 | 9493           | 3.9774035 |
| 9428           | 3.9744196 | 9461           | 3.9759370 | 9494           | 3.9774492 |
| 9429           | 3.9744656 | 9462           | 3.9759829 | 9495           | 3.9774950 |
| 9430           | 3.9745117 | 9463           | 3.9760288 | 9496           | 3.9775407 |
| 9431           | 3.9745577 | 9464           | 3.9760747 | 9497           | 3.9775864 |
| 9432           | 3.9746038 | 9465           | 3.9761206 | 9498           | 3.9776322 |
| 9433           | 3.9746498 | 9466           | 3.9761665 | 9499           | 3.9776779 |
| 9434           | 3.9746959 | 9467           | 3.9762124 | 9500           | 3.9777236 |



# 9500 A TABLE OF LOGARITHMS.

| Nº   | Logarith. | Nº   | Logarith. | Nº   | Logarith. |
|------|-----------|------|-----------|------|-----------|
| 9501 | 3.9777693 | 9534 | 3.9792751 | 9567 | 3.9807758 |
| 9502 | 3.9778150 | 9535 | 3.9793207 | 9568 | 3.9808212 |
| 9503 | 3.9778607 | 9536 | 3.9793662 | 9569 | 3.9808666 |
| 9504 | 3.9779064 | 9537 | 3.9794118 | 9570 | 3.9809119 |
| 9505 | 3.9779521 | 9538 | 3.9794573 | 9571 | 3.9809573 |
| 9506 | 3.9779978 | 9539 | 3.9795028 | 9572 | 3.9810027 |
| 9507 | 3.9780435 | 9540 | 3.9795484 | 9573 | 3.9810481 |
| 9508 | 3.9780892 | 9541 | 3.9795939 | 9574 | 3.9810934 |
| 9509 | 3.9781348 | 9542 | 3.9796394 | 9575 | 3.9811388 |
| 9510 | 3.9781805 | 9543 | 3.9796849 | 9576 | 3.9811841 |
| 9511 | 3.9782262 | 9544 | 3.9797304 | 9577 | 3.9812295 |
| 9512 | 3.9782718 | 9545 | 3.9797759 | 9578 | 3.9812748 |
| 9513 | 3.9783175 | 9546 | 3.9798214 | 9579 | 3.9813202 |
| 9514 | 3.9783631 | 9547 | 3.9798669 | 9580 | 3.9813655 |
| 9515 | 3.9784088 | 9548 | 3.9799124 | 9581 | 3.9814108 |
| 9516 | 3.9784544 | 9549 | 3.9799579 | 9582 | 3.9814562 |
| 9517 | 3.9785001 | 9550 | 3.9800034 | 9583 | 3.9815015 |
| 9518 | 3.9785457 | 9551 | 3.9800488 | 9584 | 3.9815468 |
| 9519 | 3.9785913 | 9552 | 3.9800943 | 9585 | 3.9815921 |
| 9520 | 3.9786369 | 9553 | 3.9801398 | 9586 | 3.9816374 |
| 9521 | 3.9786826 | 9554 | 3.9801852 | 9587 | 3.9816827 |
| 9522 | 3.9787282 | 9555 | 3.9802307 | 9588 | 3.9817280 |
| 9523 | 3.9787738 | 9556 | 3.9802761 | 9589 | 3.9817733 |
| 9524 | 3.9788194 | 9557 | 3.9803216 | 9590 | 3.9818186 |
| 9525 | 3.9788650 | 9558 | 3.9803670 | 9591 | 3.9818639 |
| 9526 | 3.9789106 | 9559 | 3.9804125 | 9592 | 3.9819092 |
| 9527 | 3.9789562 | 9560 | 3.9804579 | 9593 | 3.9819544 |
| 9528 | 3.9790017 | 9561 | 3.9805033 | 9594 | 3.9819997 |
| 9529 | 3.9790473 | 9562 | 3.9805487 | 9595 | 3.9820450 |
| 9530 | 3.9790929 | 9563 | 3.9805942 | 9596 | 3.9820902 |
| 9531 | 3.9791385 | 9564 | 3.9806396 | 9597 | 3.9821355 |
| 9532 | 3.9791840 | 9565 | 3.9806850 | 9598 | 3.9821807 |
| 9533 | 3.9792296 | 9566 | 3.9807304 | 9599 | 3.9822260 |
| 9534 | 3.9792751 | 9567 | 3.9807758 | 9600 | 3.9822712 |

# 9600 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith.  | N <sup>o</sup> | Logarith.  | N <sup>o</sup> | Logarith. |
|----------------|------------|----------------|------------|----------------|-----------|
| 9601           | 3.98243165 | 9634           | 3.98380600 | 9667           | 3.9852917 |
| 9602           | 3.9824617  | 9635           | 3.9838517  | 9668           | 3.9853366 |
| 9603           | 3.9824969  | 9636           | 3.9838968  | 9669           | 3.9853816 |
| 9604           | 3.982522   | 9637           | 3.9839419  | 9670           | 3.9854265 |
| 9605           | 3.9825474  | 9638           | 3.9839869  | 9671           | 3.9854714 |
| 9606           | 3.9825826  | 9639           | 3.9840320  | 9672           | 3.9855163 |
| 9607           | 3.9825878  | 9640           | 3.9840770  | 9673           | 3.9855612 |
| 9608           | 3.9826330  | 9641           | 3.9841221  | 9674           | 3.9856061 |
| 9609           | 3.9826782  | 9642           | 3.9841671  | 9675           | 3.9856510 |
| 9610           | 3.9827234  | 9643           | 3.9842122  | 9676           | 3.9856959 |
| 9611           | 3.9827686  | 9644           | 3.9842572  | 9677           | 3.9857407 |
| 9612           | 3.9828138  | 9645           | 3.9843022  | 9678           | 3.9857856 |
| 9613           | 3.9828589  | 9646           | 3.9843473  | 9679           | 3.9858305 |
| 9614           | 3.9829041  | 9647           | 3.9843923  | 9680           | 3.9858753 |
| 9615           | 3.9829493  | 9648           | 3.9844373  | 9681           | 3.9859202 |
| 9616           | 3.9829945  | 9649           | 3.9844823  | 9682           | 3.9859651 |
| 9617           | 3.9830396  | 9650           | 3.9845273  | 9683           | 3.9860099 |
| 9618           | 3.9830848  | 9651           | 3.9845723  | 9684           | 3.9860548 |
| 9619           | 3.9831299  | 9652           | 3.9846173  | 9685           | 3.9860996 |
| 9620           | 3.9831751  | 9653           | 3.9846623  | 9686           | 3.9861445 |
| 9621           | 3.9832202  | 9654           | 3.9847073  | 9687           | 3.9861893 |
| 9622           | 3.9832654  | 9655           | 3.9847523  | 9688           | 3.9862341 |
| 9623           | 3.9833105  | 9656           | 3.9847973  | 9689           | 3.9862790 |
| 9624           | 3.9833556  | 9657           | 3.9848422  | 9690           | 3.9863238 |
| 9625           | 3.9834007  | 9658           | 3.9848872  | 9691           | 3.9863686 |
| 9626           | 3.9834459  | 9659           | 3.9849322  | 9692           | 3.9864134 |
| 9627           | 3.9834910  | 9660           | 3.9849771  | 9693           | 3.9864582 |
| 9628           | 3.9835361  | 9661           | 3.9850221  | 9694           | 3.9865030 |
| 9629           | 3.9835812  | 9662           | 3.9850670  | 9695           | 3.9865478 |
| 9630           | 3.9836263  | 9663           | 3.9851120  | 9696           | 3.9865926 |
| 9631           | 3.9836714  | 9664           | 3.9851569  | 9697           | 3.9866374 |
| 9632           | 3.9837165  | 9665           | 3.9852019  | 9698           | 3.9866822 |
| 9633           | 3.9837616  | 9666           | 3.9852468  | 9699           | 3.9867270 |
| 9634           | 3.9838066  | 9667           | 3.9852917  | 9700           | 3.9867717 |

# 9700 A TABLE OF LOGARITHMS. 0000

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 9701           | 3.9858165 | 9734           | 3.9882913 | 9767           | 3.9897612 |
| 9702           | 3.9858613 | 9735           | 3.9883360 | 9768           | 3.9898057 |
| 9703           | 3.9859060 | 9736           | 3.9883806 | 9769           | 3.9898501 |
| 9704           | 3.9859508 | 9737           | 3.9884252 | 9770           | 3.9898946 |
| 9705           | 3.9859955 | 9738           | 3.9884698 | 9771           | 3.9899390 |
| 9706           | 3.9870403 | 9739           | 3.9885144 | 9772           | 3.9899835 |
| 9707           | 3.9870850 | 9740           | 3.9885590 | 9773           | 3.9900279 |
| 9708           | 3.9871298 | 9741           | 3.9886035 | 9774           | 3.9900723 |
| 9709           | 3.9871745 | 9742           | 3.9886481 | 9775           | 3.9901168 |
| 9710           | 3.9872192 | 9743           | 3.9886927 | 9776           | 3.9901612 |
| 9711           | 3.9872640 | 9744           | 3.9887373 | 9777           | 3.9902056 |
| 9712           | 3.9873087 | 9745           | 3.9887818 | 9778           | 3.9902500 |
| 9713           | 3.9873534 | 9746           | 3.9888264 | 9779           | 3.9902944 |
| 9714           | 3.9873981 | 9747           | 3.9888710 | 9780           | 3.9903389 |
| 9715           | 3.9874428 | 9748           | 3.9889155 | 9781           | 3.9903833 |
| 9716           | 3.9874875 | 9749           | 3.9889601 | 9782           | 3.9904277 |
| 9717           | 3.9875322 | 9750           | 3.9890046 | 9783           | 3.9904721 |
| 9718           | 3.9875769 | 9751           | 3.9890492 | 9784           | 3.9905164 |
| 9719           | 3.9876216 | 9752           | 3.9890937 | 9785           | 3.9905608 |
| 9720           | 3.9876663 | 9753           | 3.9891382 | 9786           | 3.9906052 |
| 9721           | 3.9877109 | 9754           | 3.9891828 | 9787           | 3.9906496 |
| 9722           | 3.9877556 | 9755           | 3.9892273 | 9788           | 3.9906940 |
| 9723           | 3.9878003 | 9756           | 3.9892718 | 9789           | 3.9907383 |
| 9724           | 3.9878450 | 9757           | 3.9893163 | 9790           | 3.9907827 |
| 9725           | 3.9878896 | 9758           | 3.9893608 | 9791           | 3.9908271 |
| 9726           | 3.9879343 | 9759           | 3.9894053 | 9792           | 3.9908714 |
| 9727           | 3.9879789 | 9760           | 3.9894498 | 9793           | 3.9909158 |
| 9728           | 3.9880236 | 9761           | 3.9894943 | 9794           | 3.9909601 |
| 9729           | 3.9880682 | 9762           | 3.9895388 | 9795           | 3.9910044 |
| 9730           | 3.9881128 | 9763           | 3.9895833 | 9796           | 3.9910488 |
| 9731           | 3.9881575 | 9764           | 3.9896278 | 9797           | 3.9910931 |
| 9732           | 3.9882021 | 9765           | 3.9896722 | 9798           | 3.9911374 |
| 9733           | 3.9882467 | 9766           | 3.9897167 | 9799           | 3.9911818 |
| 9734           | 3.9882913 | 9767           | 3.9897612 | 9800           | 3.9912261 |



# 9800 A TABLE OF LOGARITHMS.

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 9801           | 3.9912704 | 9834           | 3.9927302 | 9867           | 3.9941851 |
| 9802           | 3.9913147 | 9835           | 3.9927744 | 9868           | 3.9942291 |
| 9803           | 3.9913590 | 9836           | 3.9928185 | 9869           | 3.9942731 |
| 9804           | 3.9914033 | 9837           | 3.9928627 | 9870           | 3.9943171 |
| 9805           | 3.9914476 | 9838           | 3.9929068 | 9871           | 3.9943611 |
| 9806           | 3.9914919 | 9839           | 3.9929510 | 9872           | 3.9944051 |
| 9807           | 3.9915362 | 9840           | 3.9929951 | 9873           | 3.9944491 |
| 9808           | 3.9915805 | 9841           | 3.9930392 | 9874           | 3.9944931 |
| 9809           | 3.9916247 | 9842           | 3.9930834 | 9875           | 3.9945371 |
| 9810           | 3.9916690 | 9843           | 3.9931275 | 9876           | 3.9945811 |
| 9811           | 3.9917133 | 9844           | 3.9931716 | 9877           | 3.9946250 |
| 9812           | 3.9917575 | 9845           | 3.9932157 | 9878           | 3.9946690 |
| 9813           | 3.9918018 | 9846           | 3.9932598 | 9879           | 3.9947130 |
| 9814           | 3.9918461 | 9847           | 3.9933039 | 9880           | 3.9947569 |
| 9815           | 3.9918903 | 9848           | 3.9933480 | 9881           | 3.9948009 |
| 9816           | 3.9919345 | 9849           | 3.9933921 | 9882           | 3.9948448 |
| 9817           | 3.9919788 | 9850           | 3.9934362 | 9883           | 3.9948888 |
| 9818           | 3.9920230 | 9851           | 3.9934803 | 9884           | 3.9949327 |
| 9819           | 3.9920673 | 9852           | 3.9935244 | 9885           | 3.9949767 |
| 9820           | 3.9921115 | 9853           | 3.9935685 | 9886           | 3.9950206 |
| 9821           | 3.9921557 | 9854           | 3.9936125 | 9887           | 3.9950645 |
| 9822           | 3.9921999 | 9855           | 3.9936566 | 9888           | 3.9951085 |
| 9823           | 3.9922441 | 9856           | 3.9937007 | 9889           | 3.9951524 |
| 9824           | 3.9922884 | 9857           | 3.9937447 | 9890           | 3.9951963 |
| 9825           | 3.9923326 | 9858           | 3.9937888 | 9891           | 3.9952402 |
| 9826           | 3.9923768 | 9859           | 3.9938329 | 9892           | 3.9952841 |
| 9827           | 3.9924210 | 9860           | 3.9938769 | 9893           | 3.9953280 |
| 9828           | 3.9924651 | 9861           | 3.9939209 | 9894           | 3.9953719 |
| 9829           | 3.9925093 | 9862           | 3.9939650 | 9895           | 3.9954158 |
| 9830           | 3.9925535 | 9863           | 3.9940090 | 9896           | 3.9954597 |
| 9831           | 3.9925977 | 9864           | 3.9940531 | 9897           | 3.9955036 |
| 9832           | 3.9926419 | 9865           | 3.9940971 | 9898           | 3.9955474 |
| 9833           | 3.9926860 | 9866           | 3.9941411 | 9899           | 3.9955913 |
| 9834           | 3.9927302 | 9867           | 3.9941851 | 9900           | 3.9956352 |

9900

9900 <sup>2</sup>A TABLE of LOGARITHMS. 0080

| N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. | N <sup>o</sup> | Logarith. |
|----------------|-----------|----------------|-----------|----------------|-----------|
| 9901           | 3.9956791 | 9934           | 3.9971241 | 9967           | 3.9985645 |
| 9902           | 3.9957229 | 9935           | 3.9971679 | 9968           | 3.9986080 |
| 9903           | 3.9957668 | 9936           | 3.9972116 | 9969           | 3.9986516 |
| 9904           | 3.9958106 | 9937           | 3.9972553 | 9970           | 3.9986951 |
| 9905           | 3.9958545 | 9938           | 3.9972990 | 9971           | 3.9987387 |
| 9906           | 3.9958983 | 9939           | 3.9973427 | 9972           | 3.9987821 |
| 9907           | 3.9959422 | 9940           | 3.9973864 | 9973           | 3.9988258 |
| 9908           | 3.9959860 | 9941           | 3.9974301 | 9974           | 3.9988694 |
| 9909           | 3.9960298 | 9942           | 3.9974737 | 9975           | 3.9989129 |
| 9910           | 3.9960736 | 9943           | 3.9975174 | 9976           | 3.9989564 |
| 9911           | 3.9961175 | 9944           | 3.9975611 | 9977           | 3.9990000 |
| 9912           | 3.9961613 | 9945           | 3.9976048 | 9978           | 3.9990435 |
| 9913           | 3.9962052 | 9946           | 3.9976484 | 9979           | 3.9990870 |
| 9914           | 3.9962489 | 9947           | 3.9976921 | 9980           | 3.9991305 |
| 9915           | 3.9962927 | 9948           | 3.9977358 | 9981           | 3.9991740 |
| 9916           | 3.9963365 | 9949           | 3.9977794 | 9982           | 3.9992176 |
| 9917           | 3.9963803 | 9950           | 3.9978231 | 9983           | 3.9992611 |
| 9918           | 3.9964241 | 9951           | 3.9978667 | 9984           | 3.9993046 |
| 9919           | 3.9964679 | 9952           | 3.9979104 | 9985           | 3.9993481 |
| 9920           | 3.9965117 | 9953           | 3.9979540 | 9986           | 3.9993916 |
| 9921           | 3.9965554 | 9954           | 3.9979976 | 9987           | 3.9994350 |
| 9922           | 3.9965992 | 9955           | 3.9980413 | 9988           | 3.9994785 |
| 9923           | 3.9966430 | 9956           | 3.9980849 | 9989           | 3.9995220 |
| 9924           | 3.9966867 | 9957           | 3.9981285 | 9990           | 3.9995655 |
| 9925           | 3.9967305 | 9958           | 3.9981721 | 9991           | 3.9996089 |
| 9926           | 3.9967743 | 9959           | 3.9982157 | 9992           | 3.9996524 |
| 9927           | 3.9968180 | 9960           | 3.9982593 | 9993           | 3.9996959 |
| 9928           | 3.9968618 | 9961           | 3.9983029 | 9994           | 3.9997393 |
| 9929           | 3.9969055 | 9962           | 3.9983465 | 9995           | 3.9997828 |
| 9930           | 3.9969492 | 9963           | 3.9983901 | 9996           | 3.9998262 |
| 9931           | 3.9969930 | 9964           | 3.9984337 | 9997           | 3.9998697 |
| 9932           | 3.9970367 | 9965           | 3.9984773 | 9998           | 3.9999131 |
| 9933           | 3.9970804 | 9966           | 3.9985209 | 9999           | 3.9999566 |
| 9934           | 3.9971241 | 9967           | 3.9985645 | 10000          | 4.0000000 |

F I N I S.



